1

SEQUENCE LISTING

<110> Garvan Institute of Medical Research

<120> Novel Translocation Assay

<130> 502551/PXM

<150> AU2003904237
<151> 2003-08-08

<160> 64

<170> PatentIn version 3.1

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gcgcgtccag ctcttctaag acgag atg ccg tcg ggc ttc caa cag ata ggc   172
                            Met Pro Ser Gly Phe Gln Gln Ile Gly
                            1   5

tcc gaa gat ggg gaa ccc cct cag cag cga gtg act ggg acc ctg gtc   220
Ser Glu Asp Gly Glu Pro Pro Gln Gln Arg Val Thr Gly Thr Leu Val
10   15   20   25

ctt gct gtg ttc tct gcg gtg ctt ggc tcc ctg cag ttt ggg tac aac   268
Leu Ala Val Phe Ser Ala Val Leu Gly Ser Leu Gln Phe Gly Tyr Asn
                30   35   40

att ggg gtc atc aat gcc cct cag aag gtg att gaa cag agc tac aat   316
Ile Gly Val Ile Asn Ala Pro Gln Lys Val Ile Glu Gln Ser Tyr Asn
                45   50   55

gag acg tgg ctg ggg agg cag ggg cct gag gga ccc agc tcc atc cct   364
Glu Thr Trp Leu Gly Arg Gln Gly Pro Glu Gly Pro Ser Ser Ile Pro
            60   65   70

cca ggc acc ctc acc acc ctc tgg gcc ctc tcc gtg gcc atc ttt tcc   412
Pro Gly Thr Leu Thr Thr Leu Trp Ala Leu Ser Val Ala Ile Phe Ser
        75   80   85

gtg ggc ggc atg att tcc tcc ttc ctc att ggt atc atc tct cag tgg   460
Val Gly Gly Met Ile Ser Ser Phe Leu Ile Gly Ile Ile Ser Gln Trp
90   95   100   105

ctt gga agg aaa agg gcc atg ctg gtc aac aat gtc ctg gcg gtg ctg   508
Leu Gly Arg Lys Arg Ala Met Leu Val Asn Asn Val Leu Ala Val Leu
                110   115   120

ggg ggc agc ctc atg ggc ctg gcc aac gct gct gcc tcc tat gaa atg   556

2

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        Gly Gly Ser Leu Met Gly Leu Ala Asn Ala Ala Ala Ser Tyr Glu Met
                    125             130                 135

        ctc atc ctt gga cga ttc ctc att ggc gcc tac tca ggg ctg aca tca   604
        Leu Ile Leu Gly Arg Phe Leu Ile Gly Ala Tyr Ser Gly Leu Thr Ser
                140             145                 150

        ggg ctg gtg ccc atg tac gtg ggg gag att gct ccc act cac ctg cgg   652
        Gly Leu Val Pro Met Tyr Val Gly Glu Ile Ala Pro Thr His Leu Arg
                155             160                 165

        ggc gcc ctg ggg acg ctc aac caa ctg gcc att gtt atc ggc att ctg   700
        Gly Ala Leu Gly Thr Leu Asn Gln Leu Ala Ile Val Ile Gly Ile Leu
        170             175                 180                 185

        atc gcc cag gtg ctg ggc ttg gag tcc ctc ctg ggc act gcc agc ctg   748
        Ile Ala Gln Val Leu Gly Leu Glu Ser Leu Leu Gly Thr Ala Ser Leu
                        190                 195                 200

        tgg cca ctg ctc ctg ggc ctc aca gtg cta cct gcc ctc ctg cag ctg   796
        Trp Pro Leu Leu Leu Gly Leu Thr Val Leu Pro Ala Leu Leu Gln Leu
                    205                 210                 215

        gtc ctg ctg ccc ttc tgt ccc gag agc ccc cgc tac ctc tac atc atc   844
        Val Leu Leu Pro Phe Cys Pro Glu Ser Pro Arg Tyr Leu Tyr Ile Ile
                    220                 225                 230

        cag aat ctc gag ggg cct gcc aga aag agt ctg aag cgc ctg aca ggc   892
        Gln Asn Leu Glu Gly Pro Ala Arg Lys Ser Leu Lys Arg Leu Thr Gly
                235                 240                 245

        tgg gcc gat gtt tct gga gtg ctg gct gag ctg aag gat gag aag cgg   940
        Trp Ala Asp Val Ser Gly Val Leu Ala Glu Leu Lys Asp Glu Lys Arg
        250                 255                 260                 265

        aag ctg gag cgt gag cgg cca ctg tcc ctg ctc cag ctc ctg ggc agc   988
        Lys Leu Glu Arg Glu Arg Pro Leu Ser Leu Leu Gln Leu Leu Gly Ser
                    270                 275                 280

        cgt acc cac cgg cag ccc ctg atc att gcg gtc gtg ctg cag ctg agc   1036
        Arg Thr His Arg Gln Pro Leu Ile Ile Ala Val Val Leu Gln Leu Ser
                    285                 290                 295

        cag cag ctc tct ggc atc aat gct gtt ttc tat tat tcg acc agc atc   1084
        Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr Tyr Ser Thr Ser Ile
                    300                 305                 310

        ttc gag aca gca ggg gta ggc cag cct gcc tat gcc acc ata gga gct   1132
        Phe Glu Thr Ala Gly Val Gly Gln Pro Ala Tyr Ala Thr Ile Gly Ala
                315                 320                 325

        ggt gtg gtc aac aca gtc ttc acc ttg gtc tcg gtg ttg ttg gtg gag   1180
        Gly Val Val Asn Thr Val Phe Thr Leu Val Ser Val Leu Leu Val Glu
        330                 335                 340                 345

        cgg gcg ggg cgc cgg acg ctc cat ctc ctg ggc ctg gcg ggc atg tgt   1228
        Arg Ala Gly Arg Arg Thr Leu His Leu Leu Gly Leu Ala Gly Met Cys
                    350                 355                 360

        ggc tgt gcc atc ctg atg act gtg gct ctg ctc ctg ctg gag cga gtt   1276
        Gly Cys Ala Ile Leu Met Thr Val Ala Leu Leu Leu Leu Glu Arg Val
                365                 370                 375
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cca gcc atg agc tac gtc tcc att gtg gcc atc ttt ggc ttc gtg gca      1324
Pro Ala Met Ser Tyr Val Ser Ile Val Ala Ile Phe Gly Phe Val Ala
            380                     385                 390

ttt ttt gag att ggc cct ggc ccc att cct tgg ttc atc gtg gcc gag      1372
Phe Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp Phe Ile Val Ala Glu
    395                     400                 405

ctc ttc agc cag gga ccc cgc ccg gca gcc atg gct gtg gct ggt ttc      1420
Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Met Ala Val Ala Gly Phe
410                     415                 420                 425

tcc aac tgg acg agc aac ttc atc att ggc atg ggt ttc cag tat gtt      1468
Ser Asn Trp Thr Ser Asn Phe Ile Ile Gly Met Gly Phe Gln Tyr Val
                430                 435                 440

gcg gag gct atg ggg ccc tac gtc ttc ctt cta ttt gcg gtc ctc ctg      1516
Ala Glu Ala Met Gly Pro Tyr Val Phe Leu Leu Phe Ala Val Leu Leu
                445                 450                 455

ctg ggc ttc ttc atc ttc acc ttc tta aga gta cct gaa act cga ggc      1564
Leu Gly Phe Phe Ile Phe Thr Phe Leu Arg Val Pro Glu Thr Arg Gly
            460                 465                 470

cgg acg ttt gac cag atc tca gct gcc ttc cac cgg aca ccc tct ctt      1612
Arg Thr Phe Asp Gln Ile Ser Ala Ala Phe His Arg Thr Pro Ser Leu
        475                 480                 485

tta gag cag gag gtg aaa ccc agc aca gaa ctt gag tat tta ggg cca      1660
Leu Glu Gln Glu Val Lys Pro Ser Thr Glu Leu Glu Tyr Leu Gly Pro
490                 495                 500                 505

gat gag aac gac tgaggggcca ggcaggggtg ggagagccag ctctctctac          1712
Asp Glu Asn Asp

ccggcccaga gacccettcc tttcctctgc agcactttaa ccctctcttc cctattattt      1772

ccgggtggaa aagaatccct gcagcctggt agaattggga agctggggga agggtggtct      1832

gagcacccc tcattcccct cgtgtgactc tcttggatta tttatgtgtt gtggtttggc      1892

cgtggccatc agggtggggcc actctcccct ccctcttcct tccccatcc cctttcctcc      1952

ccaccttccc cagactcagc tccagaatac cttcttcgct gctagagaag ggggattgga      2012

gggaagacag gtctagactt tctcagtggg acaaaccaga gcagagagca ggacaggaga      2072

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4

                    20   25   30

Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35   40   45

Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
        50   55   60

Gly Pro Glu Gly Pro Ser Ser Ile Pro Pro Gly Thr Leu Thr Thr Leu
65   70   75   80

Trp Ala Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met Ile Ser Ser
                85   90   95

Phe Leu Ile Gly Ile Ile Ser Gln Trp Leu Gly Arg Lys Arg Ala Met
            100   105   110

Leu Val Asn Asn Val Leu Ala Val Leu Gly Gly Ser Leu Met Gly Leu
        115   120   125

Ala Asn Ala Ala Ala Ser Tyr Glu Met Leu Ile Leu Gly Arg Phe Leu
        130   135   140

Ile Gly Ala Tyr Ser Gly Leu Thr Ser Gly Leu Val Pro Met Tyr Val
145   150   155   160

Gly Glu Ile Ala Pro Thr His Leu Arg Gly Ala Leu Gly Thr Leu Asn
            165   170   175

Gln Leu Ala Ile Val Ile Gly Ile Leu Ile Ala Gln Val Leu Gly Leu
        180   185   190

Glu Ser Leu Leu Gly Thr Ala Ser Leu Trp Pro Leu Leu Leu Gly Leu
        195   200   205

Thr Val Leu Pro Ala Leu Leu Gln Leu Val Leu Leu Pro Phe Cys Pro
    210   215   220

Glu Ser Pro Arg Tyr Leu Tyr Ile Ile Gln Asn Leu Glu Gly Pro Ala
225   230   235   240

Arg Lys Ser Leu Lys Arg Leu Thr Gly Trp Ala Asp Val Ser Gly Val
            245   250   255

Leu Ala Glu Leu Lys Asp Glu Lys Arg Lys Leu Glu Arg Glu Arg Pro
            260   265   270

Leu Ser Leu Leu Gln Leu Leu Gly Ser Arg Thr His Arg Gln Pro Leu
        275   280   285

Ile Ile Ala Val Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn
    290   295   300

Ala Val Phe Tyr Tyr Ser Thr Ser Ile Phe Glu Thr Ala Gly Val Gly
305   310   315   320

Gln Pro Ala Tyr Ala Thr Ile Gly Ala Gly Val Val Asn Thr Val Phe
                325   330   335

Thr Leu Val Ser Val Leu Leu Val Glu Arg Ala Gly Arg Arg Thr Leu
                340   ·   345   350

His Leu Leu Gly Leu Ala Gly Met Cys Gly Cys Ala Ile Leu Met Thr
        355   360   365

Val Ala Leu Leu Leu Leu Glu Arg Val Pro Ala Met Ser Tyr Val Ser
    370   375   380

Ile Val Ala Ile Phe Gly Phe Val Ala Phe Phe Glu Ile Gly Pro Gly
385   390   395   400

Pro Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg
                405   410   415

Pro Ala Ala Met Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe
                420   425   430

Ile Ile Gly Met Gly Phe Gln Tyr Val Ala Glu Ala Met Gly Pro Tyr
        435   440   445

Val Phe Leu Leu Phe Ala Val Leu Leu Leu Gly Phe Phe Ile Phe Thr
    450   455   460

Phe Leu Arg Val Pro Glu Thr Arg Gly Arg Thr Phe Asp Gln Ile Ser
465   470   475   480

Ala Ala Phe His Arg Thr Pro Ser Leu Leu Glu Gln Glu Val Lys Pro
                485   490   495

Ser Thr Glu Leu Glu Tyr Leu Gly Pro Asp Glu Asn Asp
        500   ·   505

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1   5   10   15

cag cag cga gtg act ggg acc ctg gtc ctt gct gtg ttc tct gcg gtg   96
Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
            20   25   30

ctt ggc tcc ctg cag ttt ggg tac aac att ggg gtc atc aat gcc cct   144
Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35   40   45

cag aag gtg att gaa cag agc tac aat gag acg tgg ctg ggg agg cag   192
Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
    50   55   60

ggg cct gag atc gat tat cct tat gat gtt cct gat tat gct gag gga   240
Gly Pro Glu Ile Asp Tyr Pro Tyr Asp Val Pro Asp Tyr Ala Glu Gly
65   70   75   80

ccc agc tcc atc cct cca ggc acc ctc acc acc ctc tgg gcc ctc tcc   288
Pro Ser Ser Ile Pro Pro Gly Thr Leu Thr Thr Leu Trp Ala Leu Ser
                85   90   95

gtg gcc atc ttt tcc gtg ggc ggc atg att tcc tcc ttc ctc att ggt   336
Val Ala Ile Phe Ser Val Gly Gly Met Ile Ser Ser Phe Leu Ile Gly
            100   105   110

atc atc tct cag tgg ctt gga agg aaa agg gcc atg ctg gtc aac aat   384
Ile Ile Ser Gln Trp Leu Gly Arg Lys Arg Ala Met Leu Val Asn Asn
        115   120   125

gtc ctg gcg gtg ctg ggg ggc agc ctc atg ggc ctg gcc aac gct gct   432
Val Leu Ala Val Leu Gly Gly Ser Leu Met Gly Leu Ala Asn Ala Ala
    130   135   140

gcc tcc tat gaa atg ctc atc ctt gga cga ttc ctc att ggc gcc tac   480
Ala Ser Tyr Glu Met Leu Ile Leu Gly Arg Phe Leu Ile Gly Ala Tyr
145   150   155   160

tca ggg ctg aca tca ggg ctg gtg ccc atg tac gtg ggg gag att gct   528
Ser Gly Leu Thr Ser Gly Leu Val Pro Met Tyr Val Gly Glu Ile Ala
                165   170   175

ccc act cac ctg cgg ggc gcc ctg ggg acg ctc aac caa ctg gcc att   576
Pro Thr His Leu Arg Gly Ala Leu Gly Thr Leu Asn Gln Leu Ala Ile
            180   185   190

gtt atc ggc att ctg atc gcc cag gtg ctg ggc ttg gag tcc ctc ctg   624
Val Ile Gly Ile Leu Ile Ala Gln Val Leu Gly Leu Glu Ser Leu Leu
        195   200   205

ggc act gcc agc ctg tgg cca ctg ctc ctg ggc ctc aca gtg cta cct   672
Gly Thr Ala Ser Leu Trp Pro Leu Leu Leu Gly Leu Thr Val Leu Pro
    210   215   220

7

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gcc ctc ctg cag ctg gtc ctg ctg ccc ttc tgt ccc gag agc ccc cgc       720
Ala Leu Leu Gln Leu Val Leu Leu Pro Phe Cys Pro Glu Ser Pro Arg
225                 230             235                 240

tac ctc tac atc atc cag aat ctc gag ggg cct gcc aga aag agt ctg       768
Tyr Leu Tyr Ile Ile Gln Asn Leu Glu Gly Pro Ala Arg Lys Ser Leu
                245             250                 255

aag cgc ctg aca ggc tgg gcc gat gtt tct gga gtg ctg gct gag ctg       816
Lys Arg Leu Thr Gly Trp Ala Asp Val Ser Gly Val Leu Ala Glu Leu
            260             265                 270

aag gat gag aag cgg aag ctg gag cgt gag cgg cca ctg tcc ctg ctc       864
Lys Asp Glu Lys Arg Lys Leu Glu Arg Glu Arg Pro Leu Ser Leu Leu
            275             280                 285

cag ctc ctg ggc agc cgt acc cac cgg cag ccc ctg atc att gcg gtc       912
Gln Leu Leu Gly Ser Arg Thr His Arg Gln Pro Leu Ile Ile Ala Val
    290                 295             300

gtg ctg cag ctg agc cag cag ctc tct ggc atc aat gct gtt ttc tat       960
Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr
305                 310             315                 320

tat tcg acc agc atc ttc gag aca gca ggg gta ggc cag cct gcc tat      1008
Tyr Ser Thr Ser Ile Phe Glu Thr Ala Gly Val Gly Gln Pro Ala Tyr
                325             330                 335

gcc acc ata gga gct ggt gtg gtc aac aca gtc ttc acc ttg gtc tcg      1056
Ala Thr Ile Gly Ala Gly Val Val Asn Thr Val Phe Thr Leu Val Ser
            340             345                 350

gtg ttg ttg gtg gag cgg gcg ggg cgc cgg acg ctc cat ctc ctg ggc      1104
Val Leu Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His Leu Leu Gly
            355             360             365

ctg gcg ggc atg tgt ggc tgt gcc atc ctg atg act gtg gct ctg ctc      1152
Leu Ala Gly Met Cys Gly Cys Ala Ile Leu Met Thr Val Ala Leu Leu
    370             375             380

ctg ctg gag cga gtt cca gcc atg agc tac gtc tcc att gtg gcc atc      1200
Leu Leu Glu Arg Val Pro Ala Met Ser Tyr Val Ser Ile Val Ala Ile
385             390             395                 400

ttt ggc ttc gtg gca ttt ttt gag att ggc cct ggc ccc att cct tgg      1248
Phe Gly Phe Val Ala Phe Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp
                405             410                 415

ttc atc gtg gcc gag ctc ttc agc cag gga ccc cgc ccg gca gcc atg      1296
Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Met
            420             425                 430

gct gtg gct ggt ttc tcc aac tgg acg agc aac ttc atc att ggc atg      1344
Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe Ile Ile Gly Met
    435             440             445

ggt ttc cag tat gtt gcg gag gct atg ggg ccc tac gtc ttc ctt cta      1392
Gly Phe Gln Tyr Val Ala Glu Ala Met Gly Pro Tyr Val Phe Leu Leu
    450             455             460

ttt gcg gtc ctc ctg ctg ggc ttc ttc atc ttc acc ttc tta aga gta      1440
Phe Ala Val Leu Leu Leu Gly Phe Phe Ile Phe Thr Phe Leu Arg Val
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8

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 465                    470                    475                    480
cct gaa act cga ggc cgg acg ttt gac cag atc tca gct gcc ttc cac       1488
Pro Glu Thr Arg Gly Arg Thr Phe Asp Gln Ile Ser Ala Ala Phe His
            485                    490                    495

cgg aca ccc tct ctt tta gag cag gag gtg aaa ccc agc aca gaa ctt       1536
Arg Thr Pro Ser Leu Leu Glu Gln Glu Val Lys Pro Ser Thr Glu Leu
            500                    505                    510

gag tat tta ggg cca gat gag aac gac tga                               1566
Glu Tyr Leu Gly Pro Asp Glu Asn Asp
            515                    520
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<213>  HA tagged GLUT4

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Met Pro Ser Gly Phe Gln Gln Ile Gly Ser Glu Asp Gly Glu Pro Pro
1               5                   10                  15


Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
            20                  25                  30


Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35                  40                  45


Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
    50                  55                  60


Gly Pro Glu Ile Asp Tyr Pro Tyr Asp Val Pro Asp Tyr Ala Glu Gly
65                  70                  75                  80


Pro Ser Ser Ile Pro Pro Gly Thr Leu Thr Thr Leu Trp Ala Leu Ser
            85                  90                  95


Val Ala Ile Phe Ser Val Gly Gly Met Ile Ser Ser Phe Leu Ile Gly
            100                 105                 110


Ile Ile Ser Gln Trp Leu Gly Arg Lys Arg Ala Met Leu Val Asn Asn
        115                 120                 125


Val Leu Ala Val Leu Gly Gly Ser Leu Met Gly Leu Ala Asn Ala Ala
        130                 135                 140


Ala Ser Tyr Glu Met Leu Ile Leu Gly Arg Phe Leu Ile Gly Ala Tyr
145                 150                 155                 160


Ser Gly Leu Thr Ser Gly Leu Val Pro Met Tyr Val Gly Glu Ile Ala
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9

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                    165                    170                    175


    Pro Thr His Leu Arg Gly Ala Leu Gly Thr Leu Asn Gln Leu Ala Ile
            180                     185                 190


    Val Ile Gly Ile Leu Ile Ala Gln Val Leu Gly Leu Glu Ser Leu Leu
            195                     200                 205


    Gly Thr Ala Ser Leu Trp Pro Leu Leu Leu Gly Leu Thr Val Leu Pro
        210                 215                 220


    Ala Leu Leu Gln Leu Val Leu Leu Pro Phe Cys Pro Glu Ser Pro Arg
    225                 230                 235                 240


    Tyr Leu Tyr Ile Ile Gln Asn Leu Glu Gly Pro Ala Arg Lys Ser Leu
                245                 250                 255


    Lys Arg Leu Thr Gly Trp Ala Asp Val Ser Gly Val Leu Ala Glu Leu
            260                 265                 270


    Lys Asp Glu Lys Arg Lys Leu Glu Arg Glu Arg Pro Leu Ser Leu Leu
            275                 280                 285


    Gln Leu Leu Gly Ser Arg Thr His Arg Gln Pro Leu Ile Ile Ala Val
        290                 295                 300


    Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr
    305                 310                 315                 320


    Tyr Ser Thr Ser Ile Phe Glu Thr Ala Gly Val Gly Gln Pro Ala Tyr
                325                 330                 335


    Ala Thr Ile Gly Ala Gly Val Val Asn Thr Val Phe Thr Leu Val Ser
                340                 345                 350


    Val Leu Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His Leu Leu Gly
        355                 360                 365


    Leu Ala Gly Met Cys Gly Cys Ala Ile Leu Met Thr Val Ala Leu Leu
        370                 375                 380


    Leu Leu Glu Arg Val Pro Ala Met Ser Tyr Val Ser Ile Val Ala Ile
    385                 390                 395                 400


    Phe Gly Phe Val Ala Phe Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp
                405                 410                 415
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```
Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Met
        420                 425             430


Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe Ile Ile Gly Met
        435             440                 445


Gly Phe Gln Tyr Val Ala Glu Ala Met Gly Pro Tyr Val Phe Leu Leu
    450                 455             460


Phe Ala Val Leu Leu Leu Gly Phe Phe Ile Phe Thr Phe Leu Arg Val
465             470                 475                 480


Pro Glu Thr Arg Gly Arg Thr Phe Asp Gln Ile Ser Ala Ala Phe His
            485                 490                 495


Arg Thr Pro Ser Leu Leu Glu Gln Glu Val Lys Pro Ser Thr Glu Leu
        500                 505             510


Glu Tyr Leu Gly Pro Asp Glu Asn Asp
        515                 520


<210>   5
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<212>   PRT
<213>   GLUT4 TAIL mutant

<400>   5

Met Pro Ser Gly Phe Gln Gln Ile Gly Ser Glu Asp Gly Glu Pro Pro
1               5               10              15


Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
        20              25              30


Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35              40              45


Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
    50              55              60


Gly Pro Glu Ile Asp Glu Gly Pro Ser Ser Ile Pro Pro Gly Thr Leu
65              70              75                  80


Thr Thr Leu Trp Ala Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met
            85              90                  95


Ile Ser Ser Phe Leu Ile Gly Ile Ile Ser Gln Trp Leu Gly Arg Lys
        100                 105                 110
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11

Arg Ala Met Leu Val Asn Asn Val Leu Ala Val Leu Gly Gly Ser Leu
        115   120   125

Met Gly Leu Ala Asn Ala Ala Ala Ser Tyr Glu Met Leu Ile Leu Gly
    130   135   140

Arg Phe Leu Ile Gly Ala Tyr Ser Gly Leu Thr Ser Gly Leu Val Pro
145   150   155   160

Met Tyr Val Gly Glu Ile Ala Pro Thr His Leu Arg Gly Ala Leu Gly
            165   170   175

Thr Leu Asn Gln Leu Ala Ile Val Ile Gly Ile Leu Ile Ala Gln Val
        180   185   190

Leu Gly Leu Glu Ser Leu Leu Gly Thr Ala Ser Leu Trp Pro Leu Leu
    195   200   205

Leu Gly Leu Thr Val Leu Pro Ala Leu Leu Gln Leu Val Leu Leu Pro
    210   215   220

Phe Cys Pro Glu Ser Pro Arg Tyr Leu Tyr Ile Ile Gln Asn Leu Glu
225   230   235   240

Gly Pro Ala Arg Lys Ser Leu Lys Arg Leu Thr Gly Trp Ala Asp Val
            245   250   255

Ser Gly Val Leu Ala Glu Leu Lys Asp Glu Lys Arg Lys Leu Glu Arg
            260   265   270

Glu Arg Pro Leu Ser Leu Leu Gln Leu Leu Gly Ser Arg Thr His Arg
    275   280   285

Gln Pro Leu Ile Ile Ala Val Val Leu Gln Leu Ser Gln Gln Leu Ser
    290   295   300

Gly Ile Asn Ala Val Phe Tyr Tyr Ser Thr Ser Ile Phe Glu Thr Ala
305   310   315   320

Gly Val Gly Gln Pro Ala Tyr Ala Thr Ile Gly Ala Gly Val Val Asn
            325   330   335

Thr Val Phe Thr Leu Val Ser Val Leu Leu Val Glu Arg Ala Gly Arg
            340   345   350

Arg Thr Leu His Leu Leu Gly Leu Ala Gly Met Cys Gly Cys Ala Ile
        355   360   365

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Leu Met Thr Val Ala Leu Leu Leu Leu Glu Arg Val Pro Ala Met Ser
    370             375             380

Tyr Val Ser Ile Val Ala Ile Phe Gly Phe Val Ala Phe Phe Glu Ile
385             390             395             400

Gly Pro Gly Pro Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln
            405         410             415

Gly Pro Arg Pro Ala Ala Met Ala Val Ala Gly Phe Ser Asn Trp Thr
        420             425             430

Ser Asn Phe Ile Ile Gly Met Gly Phe Gln Tyr Val Ala Glu Ala Met
        435             440             445

Gly Pro Tyr Val Phe Leu Leu Phe Ala Val Leu Leu Leu Gly Phe Phe
    450             455             460

Ile Phe Thr Phe Leu Arg Val Pro Glu Thr Arg Gly Arg Thr Phe Asp
465             470             475             480

Gln Ile Ser Ala Ala Phe His Arg Thr Pro Ser Leu Leu Glu Gln Glu
            485             490             495

Val Lys Pro Ser Ser Ile Glu Pro Ala Lys Glu Thr Thr Thr Asn Val
        500             505             510
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<212>  PRT
<213>  HA tagged GLUT4 TAIL mutant
MPSGFQQIGSEDGEPPQQRVTGTLVLAVFSAVLGSLQFGYNIGVINAPQKVIEQSYNETWLGRQGPEIDYPYDVPDYAE
GPSSIPPGTLTTLWALSVAIFSVGGMISSFLIGIISQWLGRKRAMLVNNVLAVLGGSLMGLANAAASYEMLILGRFLIG
AYSGLTSGLVPMYVGEIAPTHLRGALGTLNQLAIVIGILIAQVLGLESLLGTASLWPLLLGLTVLPALLQLVLLPFCPE
SPRYLYIIQNLEGPARKSLKRLTGWADVSGVLAELKDEKRKLERERPLSLLQLLGSRTHRQPLIIAVVLQLSQQLSGIN
AVFYYSTSIFETAGVGQPAYATIGAGVVNTVFTLVSVLLVERAGRRTLHLLGLAGMCGCAILMTVALLLLERVPAMSYV
SIVAIFGFVAFFEIGPGPIPWFIVAELFSQGPRPAAMAVAGFSNWTSNFIIGMGFQYVAEAMGPYVFLLFAVLLLGFFI
FTFLRVPETRGRTFDQISAAFHRTPSLLEQEVKPSSIEPAKETTTNV
<seq007;prt/1;GLUT4 L489,490A mutant

<400>  6
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Met Pro Ser Gly Phe Gln Gln Ile Gly Ser Glu Asp Gly Glu Pro Pro
1           5               10              15

Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
        20              25              30

Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35              40              45
```

13

```
Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
    50                  55              60


Gly Pro Glu Ile Asp Glu Gly Pro Ser Ser Ile Pro Pro Gly Thr Leu
65              70              75              80


Thr Thr Leu Trp Ala Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met
            85              90                  95


Ile Ser Ser Phe Leu Ile Gly Ile Ile Ser Gln Trp Leu Gly Arg Lys
            100             105             110


Arg Ala Met Leu Val Asn Asn Val Leu Ala Val Leu Gly Gly Ser Leu
        115             120             125


Met Gly Leu Ala Asn Ala Ala Ala Ser Tyr Glu Met Leu Ile Leu Gly
    130             135             140


Arg Phe Leu Ile Gly Ala Tyr Ser Gly Leu Thr Ser Gly Leu Val Pro
145             150             155             160


Met Tyr Val Gly Glu Ile Ala Pro Thr His Leu Arg Gly Ala Leu Gly
            165             170             175


Thr Leu Asn Gln Leu Ala Ile Val Ile Gly Ile Leu Ile Ala Gln Val
            180             185             190


Leu Gly Leu Glu Ser Leu Leu Gly Thr Ala Ser Leu Trp Pro Leu Leu
    195             200             205


Leu Gly Leu Thr Val Leu Pro Ala Leu Leu Gln Leu Val Leu Leu Pro
    210             215             220


Phe Cys Pro Glu Ser Pro Arg Tyr Leu Tyr Ile Ile Gln Asn Leu Glu
225             230             235             240


Gly Pro Ala Arg Lys Ser Leu Lys Arg Leu Thr Gly Trp Ala Asp Val
            245             250             255


Ser Gly Val Leu Ala Glu Leu Lys Asp Glu Lys Arg Lys Leu Glu Arg
            260             265             270


Glu Arg Pro Leu Ser Leu Leu Gln Leu Leu Gly Ser Arg Thr His Arg
    275             280             285


Gln Pro Leu Ile Ile Ala Val Val Leu Gln Leu Ser Gln Gln Leu Ser
    290             295             300
```

```
Gly Ile Asn Ala Val Phe Tyr Tyr Ser Thr Ser Ile Phe Glu Thr Ala
305                 310             315             320


Gly Val Gly Gln Pro Ala Tyr Ala Thr Ile Gly Ala Gly Val Val Asn
                325             330             335


Thr Val Phe Thr Leu Val Ser Val Leu Leu Val Glu Arg Ala Gly Arg
            340             345             350


Arg Thr Leu His Leu Leu Gly Leu Ala Gly Met Cys Gly Cys Ala Ile
        355             360             365


Leu Met Thr Val Ala Leu Leu Leu Leu Glu Arg Val Pro Ala Met Ser
        370             375             380


Tyr Val Ser Ile Val Ala Ile Phe Gly Phe Val Ala Phe Phe Glu Ile
385             390             395             400


Gly Pro Gly Pro Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln
                405             410             415


Gly Pro Arg Pro Ala Ala Met Ala Val Ala Gly Phe Ser Asn Trp Thr
            420             425             430


Ser Asn Phe Ile Ile Gly Met Gly Phe Gln Tyr Val Ala Glu Ala Met
        435             440             445


Gly Pro Tyr Val Phe Leu Leu Phe Ala Val Leu Leu Leu Gly Phe Phe
    450             455             460


Ile Phe Thr Phe Leu Arg Val Pro Glu Thr Arg Gly Arg Thr Phe Asp
465             470             475             480


Gln Ile Ser Ala Ala Phe His Arg Thr Pro Ser Ala Ala Glu Gln Glu
            485             490             495


Val Lys Pro Ser Thr Glu Leu Glu Tyr Leu Gly Pro Asp Glu Asn Asp
            500             505             510


<210>   7
<211>   521
<212>   PRT
<213>   HA tagged GLUT4 L489,490A mutant

<400>   7

Met Pro Ser Gly Phe Gln Gln Ile Gly Ser Glu Asp Gly Glu Pro Pro
1               5               10              15
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Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
        20   25.   30

Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35   40   45

Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
    50   55   60

Gly Pro Glu Ile Asp Tyr Pro Tyr Asp Val Pro Asp Tyr Ala Glu Gly
65   70   75   80

Pro Ser Ser Ile Pro Pro Gly Thr Leu Thr Thr Leu Trp Ala Leu Ser
                85   90   95

Val Ala Ile Phe Ser Val Gly Gly Met Ile Ser Ser Phe Leu Ile Gly
            100   105   110

Ile Ile Ser Gln Trp Leu Gly Arg Lys Arg Ala Met Leu Val Asn Asn
        115   120   125

Val Leu Ala Val Leu Gly Gly Ser Leu Met Gly Leu Ala Asn Ala Ala
    130   135   140

Ala Ser Tyr Glu Met Leu Ile Leu Gly Arg Phe Leu Ile Gly Ala Tyr
145   150   155   160

Ser Gly Leu Thr Ser Gly Leu Val Pro Met Tyr Val Gly Glu Ile Ala
            165   170   175

Pro Thr His Leu Arg Gly Ala Leu Gly Thr Leu Asn Gln Leu Ala Ile
        180   185   190

Val Ile Gly Ile Leu Ile Ala Gln Val Leu Gly Leu Glu Ser Leu Leu
    195   200   205

Gly Thr Ala Ser Leu Trp Pro Leu Leu Leu Gly Leu Thr Val Leu Pro
    210   215   220

Ala Leu Leu Gln Leu Val Leu Leu Pro Phe Cys Pro Glu Ser Pro Arg
225   230   235   240

Tyr Leu Tyr Ile Ile Gln Asn Leu Glu Gly Pro Ala Arg Lys Ser Leu
            245   250   255

Lys Arg Leu Thr Gly Trp Ala Asp Val Ser Gly Val Leu Ala Glu Leu

16

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              260                    265                      270


      Lys Asp Glu Lys Arg Lys Leu Glu Arg Glu Arg Pro Leu Ser Leu Leu
              275                 280                 285


      Gln Leu Leu Gly Ser Arg Thr His Arg Gln Pro Leu Ile Ile Ala Val
              290                 295                 300


      Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr
      305                 310                 315                 320


      Tyr Ser Thr Ser Ile Phe Glu Thr Ala Gly Val Gly Gln Pro Ala Tyr
                      325                 330                 335


      Ala Thr Ile Gly Ala Gly Val Val Asn Thr Val Phe Thr Leu Val Ser
                  340                 345                 350


      Val Leu Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His Leu Leu Gly
              355                 360                 365


      Leu Ala Gly Met Cys Gly Cys Ala Ile Leu Met Thr Val Ala Leu Leu
          370                 375                 380


      Leu Leu Glu Arg Val Pro Ala Met Ser Tyr Val Ser Ile Val Ala Ile
      385                 390                 395                 400


      Phe Gly Phe Val Ala Phe Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp
                      405                 410                 415


      Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Met
                  420                 425                 430


      Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe Ile Ile Gly Met
                  435                 440                 445


      Gly Phe Gln Tyr Val Ala Glu Ala Met Gly Pro Tyr Val Phe Leu Leu
          450                 455                 460


      Phe Ala Val Leu Leu Leu Gly Phe Phe Ile Phe Thr Phe Leu Arg Val
      465                 470                 475                 480


      Pro Glu Thr Arg Gly Arg Thr Phe Asp Gln Ile Ser Ala Ala Phe His
                      485                 490                 495


      Arg Thr Pro Ser Ala Ala Glu Gln Glu Val Lys Pro Ser Thr Glu Leu
                  500                 505                 510
```

17

```
Glu Tyr Leu Gly Pro Asp Glu Asn Asp
        515             520


<210>   8
<211>   512
<212>   PRT
<213>   GLUT4 F5A mutant

<400>   8

Met Pro Ser Gly Ala Gln Gln Ile Gly Ser Glu Asp Gly Glu Pro Pro
1               5               10              15


Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
            20              25              30


Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35              40              45


Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
    50              55              60


Gly Pro Glu Ile Asp Glu Gly Pro Ser Ser Ile Pro Pro Gly Thr Leu
65              70              75              80


Thr Thr Leu Trp Ala Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met
            85              90              95


Ile Ser Ser Phe Leu Ile Gly Ile Ile Ser Gln Trp Leu Gly Arg Lys
            100             105             110


Arg Ala Met Leu Val Asn Asn Val Leu Ala Val Leu Gly Gly Ser Leu
        115             120             125


Met Gly Leu Ala Asn Ala Ala Ala Ser Tyr Glu Met Leu Ile Leu Gly
    130             135             140


Arg Phe Leu Ile Gly Ala Tyr Ser Gly Leu Thr Ser Gly Leu Val Pro
145             150             155             160


Met Tyr Val Gly Glu Ile Ala Pro Thr His Leu Arg Gly Ala Leu Gly
            165             170             175


Thr Leu Asn Gln Leu Ala Ile Val Ile Gly Ile Leu Ile Ala Gln Val
        180             185             190


Leu Gly Leu Glu Ser Leu Leu Gly Thr Ala Ser Leu Trp Pro Leu Leu
        195             200             205
```

18

```
Leu Gly Leu Thr Val Leu Pro Ala Leu Leu Gln Leu Val Leu Leu Pro
    210             215             220

Phe Cys Pro Glu Ser Pro Arg Tyr Leu Tyr Ile Ile Gln Asn Leu Glu
225             230             235             240

Gly Pro Ala Arg Lys Ser Leu Lys Arg Leu Thr Gly Trp Ala Asp Val
            245             250             255

Ser Gly Val Leu Ala Glu Leu Lys Asp Glu Lys Arg Lys Leu Glu Arg
            260             265             270

Glu Arg Pro Leu Ser Leu Leu Gln Leu Leu Gly Ser Arg Thr His Arg
        275             280             285

Gln Pro Leu Ile Ile Ala Val Val Leu Gln Leu Ser Gln Gln Leu Ser
    290             295             300

Gly Ile Asn Ala Val Phe Tyr Tyr Ser Thr Ser Ile Phe Glu Thr Ala
305             310             315             320

Gly Val Gly Gln Pro Ala Tyr Ala Thr Ile Gly Ala Gly Val Val Asn
            325             330             335

Thr Val Phe Thr Leu Val Ser Val Leu Leu Val Glu Arg Ala Gly Arg
            340             345             350

Arg Thr Leu His Leu Leu Gly Leu Ala Gly Met Cys Gly Cys Ala Ile
    355             360             365

Leu Met Thr Val Ala Leu Leu Leu Leu Glu Arg Val Pro Ala Met Ser
    370             375             380

Tyr Val Ser Ile Val Ala Ile Phe Gly Phe Val Ala Phe Phe Glu Ile
385             390             395             400

Gly Pro Gly Pro Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln
            405             410             415

Gly Pro Arg Pro Ala Ala Met Ala Val Ala Gly Phe Ser Asn Trp Thr
            420             425             430

Ser Asn Phe Ile Ile Gly Met Gly Phe Gln Tyr Val Ala Glu Ala Met
        435             440             445

Gly Pro Tyr Val Phe Leu Leu Phe Ala Val Leu Leu Leu Gly Phe Phe
    450             455             460
```

```
Ile Phe Thr Phe Leu Arg Val Pro Glu Thr Arg Gly Arg Thr Phe Asp
465             470         475             480


Gln Ile Ser Ala Ala Phe His Arg Thr Pro Ser Leu Leu Glu Gln Glu
            485         490             495


Val Lys Pro Ser Thr Glu Leu Glu Tyr Leu Gly Pro Asp Glu Asn Asp
            500             505             510


<210> 9
<211> 521
<212> PRT
<213> HA tagged GLUT4 F5A mutant

<400> 9

Met Pro Ser Gly Ala Gln Gln Ile Gly Ser Glu Asp Gly Glu Pro Pro
1               5               10              15


Gln Gln Arg Val Thr Gly Thr Leu Val Leu Ala Val Phe Ser Ala Val
            20              25              30


Leu Gly Ser Leu Gln Phe Gly Tyr Asn Ile Gly Val Ile Asn Ala Pro
        35              40              45


Gln Lys Val Ile Glu Gln Ser Tyr Asn Glu Thr Trp Leu Gly Arg Gln
        50              55              60


Gly Pro Glu Ile Asp Tyr Pro Tyr Asp Val Pro Asp Tyr Ala Glu Gly
65              70              75              80


Pro Ser Ser Ile Pro Pro Gly Thr Leu Thr Thr Leu Trp Ala Leu Ser
            85              90              95


Val Ala Ile Phe Ser Val Gly Gly Met Ile Ser Ser Phe Leu Ile Gly
            100             105             110


Ile Ile Ser Gln Trp Leu Gly Arg Lys Arg Ala Met Leu Val Asn Asn
        115             120             125


Val Leu Ala Val Leu Gly Gly Ser Leu Met Gly Leu Ala Asn Ala Ala
        130             135             140


Ala Ser Tyr Glu Met Leu Ile Leu Gly Arg Phe Leu Ile Gly Ala Tyr
145             150             155             160


Ser Gly Leu Thr Ser Gly Leu Val Pro Met Tyr Val Gly Glu Ile Ala
            165             170             175
```

20

Pro Thr His Leu Arg Gly Ala Leu Gly Thr Leu Asn Gln Leu Ala Ile
            180   185   190

Val Ile Gly Ile Leu Ile Ala Gln Val Leu Gly Leu Glu Ser Leu Leu
            195   200   205

Gly Thr Ala Ser Leu Trp Pro Leu Leu Leu Gly Leu Thr Val Leu Pro
        210   215   220

Ala Leu Leu Gln Leu Val Leu Leu Pro Phe Cys Pro Glu Ser Pro Arg
225   230   235   240

Tyr Leu Tyr Ile Ile Gln Asn Leu Glu Gly Pro Ala Arg Lys Ser Leu
                245   250   255

Lys Arg Leu Thr Gly Trp Ala Asp Val Ser Gly Val Leu Ala Glu Leu
            260   265   270

Lys Asp Glu Lys Arg Lys Leu Glu Arg Glu Arg Pro Leu Ser Leu Leu
        275   280   285

Gln Leu Leu Gly Ser Arg Thr His Arg Gln Pro Leu Ile Ile Ala Val
        290   295   300

Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr
305   310   315   320

Tyr Ser Thr Ser Ile Phe Glu Thr Ala Gly Val Gly Gln Pro Ala Tyr
                325   330   335

Ala Thr Ile Gly Ala Gly Val Val Asn Thr Val Phe Thr Leu Val Ser
            340   345   350

Val Leu Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His Leu Leu Gly
        355   360   365

Leu Ala Gly Met Cys Gly Cys Ala Ile Leu Met Thr Val Ala Leu Leu
        370   375   380

Leu Leu Glu Arg Val Pro Ala Met Ser Tyr Val Ser Ile Val Ala Ile
385   390   395   400

Phe Gly Phe Val Ala Phe Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp
            405   410   415

Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Met
            420   425   430

```
Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe Ile Ile Gly Met
        435                 440                 445

Gly Phe Gln Tyr Val Ala Glu Ala Met Gly Pro Tyr Val Phe Leu Leu
        450                 455                 460

Phe Ala Val Leu Leu Leu Gly Phe Phe Ile Phe Thr Phe Leu Arg Val
465                 470                 475                 480

Pro Glu Thr Arg Gly Arg Thr Phe Asp Gln Ile Ser Ala Ala Phe His
            485                 490                 495

Arg Thr Pro Ser Leu Leu Glu Gln Glu Val Lys Pro Ser Thr Glu Leu
            500                 505                 510

Glu Tyr Leu Gly Pro Asp Glu Asn Asp
        515                 520


<210>   10
<211>   2856
<212>   DNA
<213>   GLUT1

<220>
<221>   CDS
<222>   (180)..(1658)
<223>

<400>   10
tagtcgcggg tccccgagtg agcacgccag ggagcaggag accaaacgac ggggggtcgga      60

gtcagagtcg cagtgggagt·ccccggaccg gagcacgagc ctgagcggga gagcgccgct     120

cgcacgcccg tcgccacccg cgtacccggc gcagccagag ccaccagcgc agcgctgcc      179

atg gag ccc agc agc aag aag ctg acg ggt cgc ctc atg ctg gct gtg     227
Met Glu Pro Ser Ser Lys Lys Leu Thr Gly Arg Leu Met Leu Ala Val
1               5                  10                  15

gga gga gca gtg ctt ggc tcc ctg cag ttt ggc tac aac act gga gtc     275
Gly Gly Ala Val Leu Gly Ser Leu Gln Phe Gly Tyr Asn Thr Gly Val
            20                  25                  30

atc aat gcc ccc cag aag gtg atc gag gag ttc tac aac cag aca tgg     323
Ile Asn Ala Pro Gln Lys Val Ile Glu Glu Phe Tyr Asn Gln Thr Trp
        35                  40                  45

gtc cac cgc tat ggg gag agc atc ctg ccc acc acg ctc acc acg ctc     371
Val His Arg Tyr Gly Glu Ser Ile Leu Pro Thr Thr Leu Thr Thr Leu
    50                  55                  60

tgg tcc ctc tca gtg gcc atc ttt tct gtt ggg ggc atg att ggc tcc     419
Trp Ser Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met Ile Gly Ser
65                  70                  75                  80
```

22

```
ttc tct gtg ggc ctt ttc gtt aac cgc ttt ggc cgg cgg aat tca atg    467
Phe Ser Val Gly Leu Phe Val Asn Arg Phe Gly Arg Arg Asn Ser Met
            85              90              95

ctg atg atg aac ctg ctg gcc ttc gtg tcc gcc gtg ctc atg ggc ttc    515
Leu Met Met Asn Leu Leu Ala Phe Val Ser Ala Val Leu Met Gly Phe
            100             105             110

tcg aaa ctg ggc aag tcc ttt gag atg ctg atc ctg ggc cgc ttc atc    563
Ser Lys Leu Gly Lys Ser Phe Glu Met Leu Ile Leu Gly Arg Phe Ile
            115             120             125

atc ggt gtg tac tgc ggc ctg acc aca ggc ttc gtg ccc atg tat gtg    611
Ile Gly Val Tyr Cys Gly Leu Thr Thr Gly Phe Val Pro Met Tyr Val
            130             135             140

ggt gaa gtg tca ccc aca gcc ttt cgt ggg gcc ctg ggc acc ctg cac    659
Gly Glu Val Ser Pro Thr Ala Phe Arg Gly Ala Leu Gly Thr Leu His
145             150             155             160

cag ctg ggc atc gtc gtc ggc atc ctc atc gcc cag gtg ttc ggc ctg    707
Gln Leu Gly Ile Val Val Gly Ile Leu Ile Ala Gln Val Phe Gly Leu
            165             170             175

gac tcc atc atg ggc aac aag gac ctg tgg ccc ctg ctg ctg agc atc    755
Asp Ser Ile Met Gly Asn Lys Asp Leu Trp Pro Leu Leu Leu Ser Ile
            180             185             190

atc ttc atc ccg gcc ctg ctg cag tgc atc gtg ctg ccc ttc tgc ccc    803
Ile Phe Ile Pro Ala Leu Leu Gln Cys Ile Val Leu Pro Phe Cys Pro
            195             200             205

gag agt ccc cgc ttc ctg ctc atc aac cgc aac gag gag aac cgg gcc    851
Glu Ser Pro Arg Phe Leu Leu Ile Asn Arg Asn Glu Glu Asn Arg Ala
            210             215             220

aag agt gtg cta aag aag ctg cgc ggg aca gct gac gtg acc cat gac    899
Lys Ser Val Leu Lys Lys Leu Arg Gly Thr Ala Asp Val Thr His Asp
225             230             235             240

ctg cag gag atg aag gaa gag agt cgg cag atg atg cgg gag aag aag    947
Leu Gln Glu Met Lys Glu Glu Ser Arg Gln Met Met Arg Glu Lys Lys
            245             250             255

gtc acc atc ctg gag ctg ttc cgc tcc ccc gcc tac cgc cag ccc atc    995
Val Thr Ile Leu Glu Leu Phe Arg Ser Pro Ala Tyr Arg Gln Pro Ile
            260             265             270

ctc atc gct gtg gtg ctg cag ctg tcc cag cag ctg tct ggc atc aac    1043
Leu Ile Ala Val Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn
            275             280             285

gct gtc ttc tat tac tcc acg agc atc ttc gag aag gcg ggg gtg cag    1091
Ala Val Phe Tyr Tyr Ser Thr Ser Ile Phe Glu Lys Ala Gly Val Gln
            290             295             300

cag cct gtg tat gcc acc att ggc tcc ggt atc gtc aac acg gcc ttc    1139
Gln Pro Val Tyr Ala Thr Ile Gly Ser Gly Ile Val Asn Thr Ala Phe
305             310             315             320

act gtc gtg tcg ctg ttt gtg gtg gag cga gca ggc cgg cgg acc ctg    1187
Thr Val Val Ser Leu Phe Val Val Glu Arg Ala Gly Arg Arg Thr Leu
            325             330             335
```

23

```
cac ctc ata ggc ctc gct ggc atg gcg ggt tgt gcc ata ctc atg acc      1235
His Leu Ile Gly Leu Ala Gly Met Ala Gly Cys Ala Ile Leu Met Thr
            340             345             350

atc gcg cta gca ctg ctg gag cag cta ccc tgg atg tcc tat ctg agc      1283
Ile Ala Leu Ala Leu Leu Glu Gln Leu Pro Trp Met Ser Tyr Leu Ser
            355             360             365

atc gtg gcc atc ttt ggc ttt gtg gcc ttc ttt gaa gtg ggt cct ggc      1331
Ile Val Ala Ile Phe Gly Phe Val Ala Phe Phe Glu Val Gly Pro Gly
            370             375             380

ccc atc cca tgg ttc atc gtg gct gaa ctc ttc agc cag ggt cca cgt      1379
Pro Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg
385             390             395             400

cca gct gcc att gcc gtt gca ggc ttc tcc aac tgg acc tca aat ttc      1427
Pro Ala Ala Ile Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe
            405             410             415

att gtg ggc atg tgc ttc cag tat gtg gag caa ctg tgt ggt ccc tac      1475
Ile Val Gly Met Cys Phe Gln Tyr Val Glu Gln Leu Cys Gly Pro Tyr
            420             425             430

gtc ttc atc atc ttc act gtg ctc ctg gtt ctg ttc ttc atc ttc acc      1523
Val Phe Ile Ile Phe Thr Val Leu Leu Val Leu Phe Phe Ile Phe Thr
            435             440             445

tac ttc aaa gtt cct gag act aaa ggc cgg acc ttc gat gag atc gct      1571
Tyr Phe Lys Val Pro Glu Thr Lys Gly Arg Thr Phe Asp Glu Ile Ala
            450             455             460

tcc ggc ttc cgg cag ggg gga gcc agc caa agt gat aag aca ccc gag      1619
Ser Gly Phe Arg Gln Gly Gly Ala Ser Gln Ser Asp Lys Thr Pro Glu
465             470             475             480

gag ctg ttc cat ccc ctg ggg gct gat tcc caa gtg tga gtcgccccag      1668
Glu Leu Phe His Pro Leu Gly Ala Asp Ser Gln Val
            485             490

atcaccagcc cggcctgctc ccagcagccc taaggatctc tcaggagcac aggcagctgg   1728

atgagacttc aaacctgac agatgtcagc cgagccgggc ctggggctcc tttctccagc    1788

cagcaatgat gtccagaaga atattcagga cttaacggct ccaggatttt aacaaaagca   1848

agactgttgc tcaaatctat tcagacaagc aacaggtttt ataatttttt tattactgat   1908

tttgttattt ttatatcagc ctgagtctcc tgtgcccaca tcccaggctt caccctgaat   1968

ggttccatgc ctgagggtgg agactaagcc ctgtcgagac acttgccttc ttcacccagc   2028

taatctgtag ggctggacct atgtcctaag gacacactaa tcgaactatg aactacaaag   2088

cttctatccc aggaggtggc tatggccacc cgttctgctg gcctggatct ccccactcta   2148

ggggtcaggc tccattagga tttgcccctt cccatctctt cctacccaac cactcaaatt   2208

aatctttctt tacctgagac cagttgggag cactggagtg cagggaggag aggggaaggg   2268.

ccagtctggg ctgccgggtt ctagtctcct ttgcactgag ggccacacta ttaccatgag   2328
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aagagggcct gtgggagcct gcaaactcac tgctcaagaa gacatggaga ctcctgccct   2388

gttgtgtata gatgcaagat atttatatat atttttggtt gtcaatatta aatacagaca   2448

ctaagttata gtatatctgg acaagccaac ttgtaaatac accacctcac tcctgttact   2508

tacctaaaca gatataaatg gctggttttt agaaacatgg ttttgaaatg cttgtggatt   2568

gagggtagga ggtttggatg ggagtgagac agaagtaagt ggggttgcaa ccactgcaac   2628

ggcttagact tcgactcagg atccagtccc ttacacgtac ctctcatcag tgtcctcttg   2688

ctcaaaaatc tgtttgatcc ctgttaccca gagaatatat acattcttta tcttgacatt   2748

caaggcattt ctatcacata tttgatagtt ggtgttcaaa aaaacactag ttttgtgcca   2808

gccgtgatgc tcaggcttga aatcgcatta ttttgaatgt gaagggaa                2856
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<210> 11
<211> 492
<212> PRT
<213> GLUT1

<400> 11

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Met Glu Pro Ser Ser Lys Lys Leu Thr Gly Arg Leu Met Leu Ala Val
1               5                   10                  15


Gly Gly Ala Val Leu Gly Ser Leu Gln Phe Gly Tyr Asn Thr Gly Val
            20                  25                  30


Ile Asn Ala Pro Gln Lys Val Ile Glu Glu Phe Tyr Asn Gln Thr Trp
            35                  40                  45


Val His Arg Tyr Gly Glu Ser Ile Leu Pro Thr Thr Leu Thr Thr Leu
        50                  55                  60


Trp Ser Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met Ile Gly Ser
65                  70                  75                  80


Phe Ser Val Gly Leu Phe Val Asn Arg Phe Gly Arg Arg Asn Ser Met
                85                  90                  95


Leu Met Met Asn Leu Leu Ala Phe Val Ser Ala Val Leu Met Gly Phe
                100                 105                 110


Ser Lys Leu Gly Lys Ser Phe Glu Met Leu Ile Leu Gly Arg Phe Ile
            115                 120                 125


Ile Gly Val Tyr Cys Gly Leu Thr Thr Gly Phe Val Pro Met Tyr Val
            130                 135                 140


Gly Glu Val Ser Pro Thr Ala Phe Arg Gly Ala Leu Gly Thr Leu His
```

25

```
145                    150                    155                    160


Gln Leu Gly Ile Val Val Gly Ile Leu Ile Ala Gln Val Phe Gly Leu
            165                    170                    175


Asp Ser Ile Met Gly Asn Lys Asp Leu Trp Pro Leu Leu Leu Ser Ile
            180                    185                    190


Ile Phe Ile Pro Ala Leu Leu Gln Cys Ile Val Leu Pro Phe Cys Pro
            195                    200                    205


Glu Ser Pro Arg Phe Leu Leu Ile Asn Arg Asn Glu Glu Asn Arg Ala
    210                    215                    220


Lys Ser Val Leu Lys Lys Leu Arg Gly Thr Ala Asp Val Thr His Asp
225                    230                    235                    240


Leu Gln Glu Met Lys Glu Glu Ser Arg Gln Met Met Arg Glu Lys Lys
            245                    250                    255


Val Thr Ile Leu Glu Leu Phe Arg Ser Pro Ala Tyr Arg Gln Pro Ile
            260                    265                    270


Leu Ile Ala Val Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn
            275                    280                    285


Ala Val Phe Tyr Tyr Ser Thr Ser Ile Phe Glu Lys Ala Gly Val Gln
    290                    295                    300


Gln Pro Val Tyr Ala Thr Ile Gly Ser Gly Ile Val Asn Thr Ala Phe
305                    310                    315                    320


Thr Val Val Ser Leu Phe Val Val Glu Arg Ala Gly Arg Arg Thr Leu
            325                    330                    335


His Leu Ile Gly Leu Ala Gly Met Ala Gly Cys Ala Ile Leu Met Thr
            340                    345                    350


Ile Ala Leu Ala Leu Leu Glu Gln Leu Pro Trp Met Ser Tyr Leu Ser
            355                    360                    365


Ile Val Ala Ile Phe Gly Phe Val Ala Phe Phe Glu Val Gly Pro Gly
    370                    375                    380


Pro Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg
385                    390                    395                    400
```

26

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Pro Ala Ala Ile Ala Val Ala Gly Phe Ser Asn Trp Thr Ser Asn Phe
            405             410             415


Ile Val Gly Met Cys Phe Gln Tyr Val Glu Gln Leu Cys Gly Pro Tyr
            420             425             430


Val Phe Ile Ile Phe Thr Val Leu Leu Val Leu Phe Phe Ile Phe Thr
            435             440             445


Tyr Phe Lys Val Pro Glu Thr Lys Gly Arg Thr Phe Asp Glu Ile Ala
    450             455             460


Ser Gly Phe Arg Gln Gly Gly Ala Ser Gln Ser Asp Lys Thr Pro Glu
465             470             475             480


Glu Leu Phe His Pro Leu Gly Ala Asp Ser Gln Val
            485             490


<210>  12
<211>  1506
<212>  DNA
<213>  HA tagged GLUT1

<220>
<221>  CDS
<222>  (1)..(1506)
<223>

<400>  12
atg gag ccc agc agc aag aag ctg acg ggt cgc ctc atg ctg gct gtg      48
Met Glu Pro Ser Ser Lys Lys Leu Thr Gly Arg Leu Met Leu Ala Val
1               5                   10                  15

gga gga gca gtg ctt ggc tcc ctg cag ttt ggc tac aac act gga gtc     ·96
Gly Gly Ala Val Leu Gly Ser Leu Gln Phe Gly Tyr Asn Thr Gly Val
            20                  25                  30

atc aat gcc ccc cag aag gtg atc gag gag ttc tac aac cag aca tgg     144
Ile Asn Ala Pro Gln Lys Val Ile Glu Glu Phe Tyr Asn Gln Thr Trp
        35                  40                  45

gtc cac cgc tat ggg gag agc atc tac cca tac gac gtc cca gac tac     192
Val His Arg Tyr Gly Glu Ser Ile .Tyr Pro Tyr Asp Val Pro Asp Tyr
    50                  55                  60

gct ctg ccc acc acg ctc acc acg ctc tgg tcc ctc tca gtg gcc atc     240
Ala Leu Pro Thr Thr Leu Thr Thr Leu Trp Ser Leu Ser Val Ala Ile
65                  70                  75                  80

ttt tct gtt ggg ggc atg att ggc tcc ttc tct gtg ggc ctt ttc gtt     288
Phe Ser Val Gly Gly Met Ile Gly Ser Phe Ser Val Gly Leu Phe Val
            85                  90                  95

aac cgc ttt ggc cgg cgg aat tca atg ctg atg atg aac ctg ctg gcc     336
Asn Arg Phe Gly Arg Arg Asn Ser Met Leu Met Met Asn Leu Leu Ala
            100                 105                 110
```

27

ttc gtg tcc gcc gtg ctc atg ggc ttc tcg aaa ctg ggc aag tcc ttt   384
Phe Val Ser Ala Val Leu Met Gly Phe Ser Lys Leu Gly Lys Ser Phe
        115   120   125

gag atg ctg atc ctg ggc cgc ttc atc atc ggt gtg tac tgc ggc ctg   432
Glu Met Leu Ile Leu Gly Arg Phe Ile Ile Gly Val Tyr Cys Gly Leu
    130   135   140

acc aca ggc ttc gtg ccc atg tat gtg ggt gaa gtg tca ccc aca gcc   480
Thr Thr Gly Phe Val Pro Met Tyr Val Gly Glu Val Ser Pro Thr Ala
145   150   155   160

ttt cgt ggg gcc ctg ggc acc ctg cac cag ctg ggc atc gtc gtc ggc   528
Phe Arg Gly Ala Leu Gly Thr Leu His Gln Leu Gly Ile Val Val Gly
            165   170   175

atc ctc atc gcc cag gtg ttc ggc ctg gac tcc atc atg ggc aac aag   576
Ile Leu Ile Ala Gln Val Phe Gly Leu Asp Ser Ile Met Gly Asn Lys
        180   185   190

gac ctg tgg ccc ctg ctg ctg agc atc atc ttc atc ccg gcc ctg ctg   624
Asp Leu Trp Pro Leu Leu Leu Ser Ile Ile Phe Ile Pro Ala Leu Leu
        195   200   205

cag tgc atc gtg ctg ccc ttc tgc ccc gag agt ccc cgc ttc ctg ctc   672
Gln Cys Ile Val Leu Pro Phe Cys Pro Glu Ser Pro Arg Phe Leu Leu
    210   215   220

atc aac cgc aac gag gag aac cgg gcc aag agt gtg cta aag aag ctg   720
Ile Asn Arg Asn Glu Glu Asn Arg Ala Lys Ser Val Leu Lys Lys Leu
225   230   235   240

cgc ggg aca gct gac gtg acc cat gac ctg cag gag atg aag gaa gag   768
Arg Gly Thr Ala Asp Val Thr His Asp Leu Gln Glu Met Lys Glu Glu
            245   250   255

agt cgg cag atg atg cgg gag aag aag gtc acc atc ctg gag ctg ttc   816
Ser Arg Gln Met Met Arg Glu Lys Lys Val Thr Ile Leu Glu Leu Phe
        260   265   270

cgc tcc ccc gcc tac cgc cag ccc atc ctc atc gct gtg gtg ctg cag   864
Arg Ser Pro Ala Tyr Arg Gln Pro Ile Leu Ile Ala Val Val Leu Gln
        275   280   285

ctg tcc cag cag ctg tct ggc atc aac gct gtc ttc tat tac tcc acg   912
Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr Tyr Ser Thr
    290   295   300

agc atc ttc gag aag gcg ggg gtg cag cag cct gtg tat gcc acc att   960
Ser Ile Phe Glu Lys Ala Gly Val Gln Gln Pro Val Tyr Ala Thr Ile
305   310   315   320

ggc tcc ggt atc gtc aac acg gcc ttc act gtc gtg tcg ctg ttt gtg   1008
Gly Ser Gly Ile Val Asn Thr Ala Phe Thr Val Val Ser Leu Phe Val
            325   330   335

gtg gag cga gca ggc cgg cgg acc ctg cac ctc ata ggc ctc gct ggc   1056
Val Glu Arg Ala Gly Arg Arg Thr Leu His Leu Ile Gly Leu Ala Gly
        340   345   350

atg gcg ggt tgt gcc ata ctc atg acc atc gcg cta gca ctg ctg gag   1104
Met Ala Gly Cys Ala Ile Leu Met Thr Ile Ala Leu Ala Leu Leu Glu
        355   360   365

```
cag cta ccc tgg atg tcc tat ctg agc atc gtg gcc atc ttt ggc ttt     1152
Gln Leu Pro Trp Met Ser Tyr Leu Ser Ile Val Ala Ile Phe Gly Phe
    370             375             380

gtg gcc ttc ttt gaa gtg ggt cct ggc ccc atc cca tgg ttc atc gtg     1200
Val Ala Phe Phe Glu Val Gly Pro Gly Pro Ile Pro Trp Phe Ile Val
385             390             395             400

gct gaa ctc ttc agc cag ggt cca cgt cca gct gcc att gcc gtt gca     1248
Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Ile Ala Val Ala
                405             410             415

ggc ttc tcc aac tgg acc tca aat ttc att gtg ggc atg tgc ttc cag     1296
Gly Phe Ser Asn Trp Thr Ser Asn Phe Ile Val Gly Met Cys Phe Gln
            420             425             430

tat gtg gag caa ctg tgt ggt ccc tac gtc ttc atc atc ttc act gtg     1344
Tyr Val Glu Gln Leu Cys Gly Pro Tyr Val Phe Ile Ile Phe Thr Val
        435             440             445

ctc ctg gtt ctg ttc ttc atc ttc acc tac ttc aaa gtt cct gag act     1392
Leu Leu Val Leu Phe Phe Ile Phe Thr Tyr Phe Lys Val Pro Glu Thr
    450             455             460

aaa ggc cgg acc ttc gat gag atc gct tcc ggc ttc cgg cag ggg gga     1440
Lys Gly Arg Thr Phe Asp Glu Ile Ala Ser Gly Phe Arg Gln Gly Gly
465             470             475             480

gcc agc caa agt gat aag aca ccc gag gag ctg ttc cat ccc ctg ggg     1488
Ala Ser Gln Ser Asp Lys Thr Pro Glu Glu Leu Phe His Pro Leu Gly
                485             490             495

gct gat tcc caa gtg tga                                             1506
Ala Asp Ser Gln Val
            500
```

```
<210>  13
<211>  501
<212>  PRT
<213>  HA tagged GLUT1

<400>  13

Met Glu Pro Ser Ser Lys Lys Leu Thr Gly Arg Leu Met Leu Ala Val
1               5               10              15


Gly Gly Ala Val Leu Gly Ser Leu Gln Phe Gly Tyr Asn Thr Gly Val
            20              25              30


Ile Asn Ala Pro Gln Lys Val Ile Glu Glu Phe Tyr Asn Gln Thr Trp
            35              40              45


Val His Arg Tyr Gly Glu Ser Ile Tyr Pro Tyr Asp Val Pro Asp Tyr
        50              55              ·60


Ala Leu Pro Thr Thr Leu Thr Thr Leu Trp Ser Leu Ser Val Ala Ile
65              70              75              80
```

```
Phe Ser Val Gly Gly Met Ile Gly Ser Phe Ser Val Gly Leu Phe Val
                85              90              95

Asn Arg Phe Gly Arg Arg Asn Ser Met Leu Met Met Asn Leu Leu Ala
            100             105             110

Phe Val Ser Ala Val Leu Met Gly Phe Ser Lys Leu Gly Lys Ser Phe
        115             120             125

Glu Met Leu Ile Leu Gly Arg Phe Ile Ile Gly Val Tyr Cys Gly Leu
    130             135             140

Thr Thr Gly Phe Val Pro Met Tyr Val Gly Glu Val Ser Pro Thr Ala
145             150             155             160

Phe Arg Gly Ala Leu Gly Thr Leu His Gln Leu Gly Ile Val Val Gly
            165             170             175

Ile Leu Ile Ala Gln Val Phe Gly Leu Asp Ser Ile Met Gly Asn Lys
            180             185             190

Asp Leu Trp Pro Leu Leu Leu Ser Ile Ile Phe Ile Pro Ala Leu Leu
            195             200             205

Gln Cys Ile Val Leu Pro Phe Cys Pro Glu Ser Pro Arg Phe Leu Leu
    210             215             220

Ile Asn Arg Asn Glu Glu Asn Arg Ala Lys Ser Val Leu Lys Lys Leu
225             230             235             240

Arg Gly Thr Ala Asp Val Thr His Asp Leu Gln Glu Met Lys Glu Glu
            245             250             255

Ser Arg Gln Met Met Arg Glu Lys Lys Val Thr Ile Leu Glu Leu Phe
        260             265             270

Arg Ser Pro Ala Tyr Arg Gln Pro Ile Leu Ile Ala Val Val Leu Gln
        275             280             285

Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr Tyr Ser Thr
    290             295             300

Ser Ile Phe Glu Lys Ala Gly Val Gln Gln Pro Val Tyr Ala Thr Ile
305             310             315             320

Gly Ser Gly Ile Val Asn Thr Ala Phe Thr Val Val Ser Leu Phe Val
```

30

```
                  325                    330                    335


    Val Glu Arg Ala Gly Arg Arg Thr Leu His Leu Ile Gly Leu Ala Gly
            340                 345                 350


    Met Ala Gly Cys Ala Ile Leu Met Thr Ile Ala Leu Ala Leu Leu Glu
            355                 360                 365


    Gln Leu Pro Trp Met Ser Tyr Leu Ser Ile Val Ala Ile Phe Gly Phe
        370                 375                 380


    Val Ala Phe Phe Glu Val Gly Pro Gly Pro Ile Pro Trp Phe Ile Val
    385                 390                 395                 400


    Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Ile Ala Val Ala
                405                 410                 415


    Gly Phe Ser Asn Trp Thr Ser Asn Phe Ile Val Gly Met Cys Phe Gln
            420                 425                 430


    Tyr Val Glu Gln Leu Cys Gly Pro Tyr Val Phe Ile Ile Phe Thr Val
            435                 440                 445


    Leu Leu Val Leu Phe Phe Ile Phe Thr Tyr Phe Lys Val Pro Glu Thr
        450                 455                 460


    Lys Gly Arg Thr Phe Asp Glu Ile Ala Ser Gly Phe Arg Gln Gly Gly
    465                 470                 475                 480


    Ala Ser Gln Ser Asp Lys Thr Pro Glu Glu Leu Phe His Pro Leu Gly
                485                 490                 495


    Ala Asp Ser Gln Val
                500


    <210>   14
    <211>   9
    <212>   PRT
    <213>   HA epitope

    <400>   14

    Tyr Pro Tyr Asp Val Pro Asp Tyr Ala
    1               5


    <210>   15
    <211>   14
    <212>   PRT
    <213>   Simian Virus 5 epitope (SV5)
```

<400> 15

Gly Lys Pro Ile Pro Asn Pro Leu Leu Gly Leu Asp Ser Thr
1   5   10

<210> 16
<211> 6
<212> PRT
<213> hexa-his

<400> 16

His His His His His His
1   5

<210> 17
<211> 10
<212> PRT
<213> c-myc epitope

<400> 17

Phe Gln Lys Leu Ile Ser Glu Glu Asp Leu
1   5   10

<210> 18
<211> 9
<212> PRT
<213> FLAG epitope

<400> 18

Asp Tyr Lys Asp Asp Asp Asp Lys Cys
1   5

<210> 19
<211> 9
<212> PRT
<213> Alternative FLAG epitope

<400> 19

Met Asp Phe Lys Asp Asp Asp Asp Lys
1   5

<210> 20
<211> 9
<212> PRT
<213> Alternative FLAG epitope

<400> 20

Met Asp Tyr Lys Ala Phe Asp Asn Leu
1   5

<210> 21
<211> 223

```
<212>   PRT
<213>   glutathione-S-transferase

<400>   21

Met Ala Lys Leu Pro Ile Leu Gly Tyr Trp Lys Ile Lys Gly Leu Val
1               5               10              15


Gln Pro Thr Arg Leu Leu Leu Glu Tyr Leu Glu Glu Lys Tyr Glu Glu
            20              25              30


His Leu Tyr Glu Arg Asp Glu Gly Asp Lys Trp Arg Asn Lys Lys Phe
        35              40              45


Glu Leu Gly Leu Glu Phe Pro Asn Leu Pro Tyr Tyr Ile Asp Gly Asp
    50              55              60


Val Lys Leu Thr Gln Ser Met Ala Ile Ile Arg Tyr Ile Ala Asp Lys
65              70              75              80


His Asn Met Leu Gly Gly Cys Pro Lys Glu Arg Ala Glu Ile Ser Met
            85              90              95


Leu Glu Gly Ala Val Leu Asp Ile Arg Tyr Gly Val Ser Arg Ile Ala
            100             105             110


Tyr Ser Lys Asp Phe Glu Thr Leu Lys Val Asp Phe Leu Ser Lys Leu
        115             120             125


Pro Glu Met Leu Lys Met Phe Glu Asp Arg Leu Cys His Lys Thr Tyr
    130             135             140


Leu Asn Gly Asp His Val Thr His Pro Asp Phe Met Leu Tyr Asp Ala
145             150             155             160


Leu Asp Val Val Leu Tyr Met Asp Pro Met Cys Leu Asp Ala Phe Pro
            165             170             175


Lys Leu Val Cys Phe Lys Lys Arg Ile Glu Ala Ile Pro Gln Ile Asp
            180             185             190


Lys Tyr Leu Lys Ser Ser Lys Tyr Ile Ala Trp Pro Leu Gln Gly Trp
        195             200             205


Gln Ala Thr Phe Gly Gly Gly Asp His Pro Pro Lys Ser Asp Leu
    210             215             220


<210>   22
<211>   488
```

```
<212>  PRT
<213>  maltose binding protein

<400>  22

Met Lys Ile Glu Glu Gly Lys Leu Val Ile Trp Ile Asn Gly Asp Lys
1               5                   10                  15


Gly Tyr Asn Gly Leu Ala Glu Val Gly Lys Lys Phe Glu Lys Asp Thr
            20                  25                  30


Gly Ile Lys Val Thr Val Glu His Pro Asp Lys Leu Glu Glu Lys Phe
        35                  40                  45


Pro Gln Val Ala Ala Thr Gly Asp Gly Pro Asp Ile Ile Phe Trp Ala
    50                  55                  60


His Asp Arg Phe Gly Gly Tyr Ala Gln Ser Gly Leu Leu Ala Glu Ile
65                  70                  75                  80


Thr Pro Asp Lys Ala Phe Gln Asp Lys Leu Tyr Pro Phe Thr Trp Asp
                85                  90                  95


Ala Val Arg Tyr Asn Gly Lys Leu Ile Ala Tyr Pro Ile Ala Val Glu
            100                 105                 110


Ala Leu Ser Leu Ile Tyr Asn Lys Asp Leu Leu Pro Asn Pro Pro Lys
        115                 120                 125


Thr Trp Glu Glu Ile Pro Ala Leu Asp Lys Glu Leu Lys Ala Lys Gly
    130                 135                 140


Lys Ser Ala Leu Met Phe Asn Leu Gln Glu Pro Tyr Phe Thr Trp Pro
145                 150                 155                 160


Leu Ile Ala Ala Asp Gly Gly Tyr Ala Phe Lys Tyr Glu Asn Gly Lys
                165                 170                 175


Tyr Asp Ile Lys Asp Val Gly Val Asp Asn Ala Gly Ala Lys Ala Gly
            180                 185                 190


Leu Thr Phe Leu Val Asp Leu Ile Lys Asn Lys His Met Asn Ala Asp
        195                 200                 205


Thr Asp Tyr Ser Ile Ala Glu Ala Ala Phe Asn Lys Gly Glu Thr Ala
    210                 215                 220


Met Thr Ile Asn Gly Pro Trp Ala Trp Ser Asn Ile Asp Thr Ser Lys
225                 230                 235                 240
```

```
Val Asn Tyr Gly Val Thr Val Leu Pro Thr Phe Lys Gly Gln Pro Ser
            245          .          250              255


Lys Pro Phe Val Gly Val Leu Ser Ala Gly Ile Asn Ala Ala Ser Pro
            260              265              270


Asn Lys Glu Leu Ala Lys Glu Phe Leu Glu Asn Tyr Leu Leu Thr Asp
        275              280              285


Glu Gly Leu Glu Ala Val Asn Lys Asp Lys Pro Leu Gly Ala Val Ala
    290              295              300


Leu Lys Ser Tyr Glu Glu Glu Leu Ala Lys Asp Pro Arg Ile Ala Ala
305              310              315              320


Thr Met Glu Asn Ala Gln Lys Gly Glu Ile Met Pro Asn Ile Pro Gln
            325              330              335


Met Ser Ala Phe Trp Tyr Ala Val Arg Thr Ala Val Ile Asn Ala Ala
            340              345              350


Ser Gly Arg Gln Thr Val Asp Glu Ala Leu Lys Asp Ala Gln Thr Asn
        355              360              365


Ser Ser Ser Asn Asn Asn Asn Asn Asn Asn Asn Asn Leu Gly Ile
    370              375              380


Asp Thr Thr Glu Asn Leu Tyr Phe Gln Gly Ala Met Asp Pro Glu Phe
385              390              395              400


Lys Gly Leu Arg Arg Arg Ala Gln Leu Val Arg Pro Leu Ser Asn Leu
            405              410              415


Glu Pro Ala Val Ser Arg His Ala Val Pro Ser Leu Ala Leu Ala Val
            420              425              430


Val Leu Gln Arg Arg Asp Trp Glu Asn Pro Gly Val Thr Gln Leu Asn
        435              440              445


Arg Leu Ala Ala His Pro Pro Phe Ala Ser Trp Arg Asn Ser Glu Glu
    450              455              460


Ala Arg Thr Asp Arg Pro Ser Gln Gln Leu Arg Ser Leu Asn Gly Glu
465              470              475              480


Trp Gln Leu Gly Cys Phe Gly Gly
```

485

```
<210>    23
<211>    168
<212>    PRT
<213>    GAL4

<400>    23

Met Lys Leu Leu Ser Ser Ile Glu Gln Ala Cys Asp Ile Cys Arg Leu
1               5                   10                  15


Lys Lys Leu Lys Cys Ser Lys Glu Lys Pro Lys Cys Ala Lys Cys Leu
            20                  25                  30


Lys Asn Asn Trp Glu Cys Arg Tyr Ser Pro Lys Thr Lys Arg Ser Pro
        35                  40                  45


Leu Thr Arg Ala His Leu Thr Glu Val Glu Ser Arg Leu Glu Arg Leu
    50                  55                  60


Glu Gln Leu Phe Leu Leu Ile Phe Pro Arg Glu Asp Leu Asp Met Ile
65                  70                  75                  80


Leu Lys Met Asp Ser Leu Gln Asp Ile Lys Ala Leu Leu Thr Gly Leu
                85                  90                  95


Phe Val Gln Asp Asn Val Asn Lys Asp Ala Val Thr Asp Arg Leu Ala
            100                 105                 110


Ser Val Glu Thr Asp Met Pro Leu Thr Leu Arg Gln His Arg Ile Ser
        115                 120                 125


Ala Thr Ser Ser Ser Glu Glu Ser Ser Asn Lys Gly Gln Arg Gln Leu
        130                 135                 140


Thr Val Ser Pro Glu Phe Pro Gly Ile Arg Arg Leu Asp Ala Leu Ile
145                 150                 155                 160


Ser Ser Arg Ala Ala Ala Gly Thr
                165


<210>    24
<211>    1045
<212>    PRT
<213>    beta-galactosidase

<400>    24

Met Ser Phe Thr Leu Thr Asn Lys Asn Val Ile Phe Val Ala Gly Leu
1               5                   10                  15
```

36

Gly Gly Ile Gly Leu Asp Thr Ser Lys Glu Leu Leu Lys Arg Asp Pro
         20   25   30

Val Val Leu Gln Arg Arg Asp Trp Glu Asn Pro Gly Val Thr Gln Leu
         35   40   45

Asn Arg Leu Ala Ala His Pro Pro Phe Ala Ser Trp Arg Asn Ser Glu
   50   55   60

Glu Ala Arg Thr Asp Arg Pro Ser Gln Gln Leu Arg Ser Leu Asn Gly
65   70   75   80

Glu Trp Arg Phe Ala Trp Phe Pro Ala Pro Glu Ala Val Pro Glu Ser
         85   90   95

Trp Leu Glu Cys Asp Leu Pro Glu Ala Asp Thr Val Val Val Pro Ser
         100   105   110

Asn Trp Gln Met His Gly Tyr Asp Ala Pro Ile Tyr Thr Asn Val Thr
         115   120   125

Tyr Pro Ile Thr Val Asn Pro Pro Phe Val Pro Thr Glu Asn Pro Thr
         130   135   140

Gly Cys Tyr Ser Leu Thr Phe Asn Val Asp Glu Ser Trp Leu Gln Glu
145   150   155   160

Gly Gln Thr Arg Ile Ile Phe Asp Gly Val Asn Ser Ala Phe His Leu
         165   170   175

Trp Cys Asn Gly Arg Trp Val Gly Tyr Gly Gln Asp Ser Arg Leu Pro
         180   185   190

Ser Glu Phe Asp Leu Ser Ala Phe Leu Arg Ala Gly Glu Asn Arg Leu
         195   200   205

Ala Val Met Val Leu Arg Trp Ser Asp Gly Ser Tyr Leu Glu Asp Gln
         210   215   220

Asp Met Trp Arg Met Ser Gly Ile Phe Arg Asp Val Ser Leu Leu His
225   230   235   240

Lys Pro Thr Thr Gln Ile Ser Asp Phe His Val Ala Thr Arg Phe Asn
         245   250   255

Asp Asp Phe Ser Arg Ala Val Leu Glu Ala Glu Val Gln Met Cys Gly

37

```
              260                   265                   270

    Glu Leu Arg Asp Tyr Leu Arg Val Thr Val Ser Leu Trp Gln Gly Glu
            275                 280                 285


    Thr Gln Val Ala Ser Gly Thr Ala Pro Phe Gly Gly Glu Ile Ile Asp
            290                 295                 300


    Glu Arg Gly Gly Tyr Ala Asp Arg Val Thr Leu Arg Leu Asn Val Glu
    305                 310                 315                 320


    Asn Pro Lys Leu Trp Ser Ala Glu Ile Pro Asn Leu Tyr Arg Ala Val
                    325                 330                 335


    Val Glu Leu His Thr Ala Asp Gly Thr Leu Ile Glu Ala Glu Ala Cys
            340                 345                 350


    Asp Val Gly Phe Arg Glu Val Arg Ile Glu Asn Gly Leu Leu Leu Leu
            355                 360                 365


    Asn Gly Lys Pro Leu Leu Ile Arg Gly Val Asn Arg His Glu His His
            370                 375                 380


    Pro Leu His Gly Gln Val Met Asp Glu Gln Thr Met Val Gln Asp Ile
    385                 390                 395                 400


    Leu Leu Met Lys Gln Asn Asn Phe Asn Ala Val Arg Cys Ser His Tyr
                    405                 410                 415


    Pro Asn His Pro Leu Trp Tyr Thr Leu Cys Asp Arg Tyr Gly Leu Tyr
                420                 425                 430


    Val Val Asp Glu Ala Asn Ile Glu Thr His Gly Met Val Pro Met Asn
                435                 440                 445


    Arg Leu Thr Asp Asp Pro Arg Trp Leu Pro Ala Met Ser Glu Arg Val
            450                 455                 460


    Thr Arg Met Val Gln Arg Asp Arg Asn His Pro Ser Val Ile Ile Trp
    465                 470                 475                 480


    Ser Leu Gly Asn Glu Ser Gly His Gly Ala Asn His Asp Ala Leu Tyr
                    485                 490                 495


    Arg Trp Ile Lys Ser Val Asp Pro Ser Arg Pro Val Gln Tyr Glu Gly
                500                 505                 510
```

38

Gly Gly Ala Asp Thr Thr Ala Thr Asp Ile Ile Cys Pro Met Tyr Ala
        515   520   525

Arg Val Asp Glu Asp Gln Pro Phe Pro Ala Val Pro Lys Trp Ser Ile
    530   535   540

Lys Lys Trp Leu Ser Leu Pro Gly Glu Thr Arg Pro Leu Ile Leu Cys
545   550   555   560

Glu Tyr Ala His Ala Met Gly Asn Ser Leu Gly Gly Phe Ala Lys Tyr
            565   570   575

Trp Gln Ala Phe Arg Gln Tyr Pro Arg Leu Gln Gly Gly Phe Val Trp
        580   585   590

Asp Trp Val Asp Gln Ser Leu Ile Lys Tyr Asp Glu Asn Gly Asn Pro
    595   600   605

Trp Ser Ala Tyr Gly Gly Asp Phe Gly Asp Thr Pro Asn Asp Arg Gln
    610   615   620

Phe Cys Met Asn Gly Leu Val Phe Ala Asp Arg Thr Pro His Pro Ala
625   630   635   640

Leu Thr Glu Ala Lys His Gln Gln Gln Phe Phe Gln Phe Arg Leu Ser
            645   650   655

Gly Gln Thr Ile Glu Val Thr Ser Glu Tyr Leu Phe Arg His Ser Asp
            660   665   670

Asn Glu Leu Leu His Trp Met Val Ala Leu Asp Gly Lys Pro Leu Ala
        675   680   685

Ser Gly Glu Val Pro Leu Asp Val Ala Pro Gln Gly Lys Gln Leu Ile
    690   695   700

Glu Leu Pro Glu Leu Pro Gln Pro Glu Ser Ala Gly Gln Leu Trp Leu
705   710   715   720

Thr Val Arg Val Val Gln Pro Asn Ala Thr Ala Trp Ser Glu Ala Gly
            725   730   735

His Ile Ser Ala Trp Gln Gln Trp Arg Leu Ala Glu Asn Leu Ser Val
        740   745   750

Thr Leu Pro Ala Ala Ser His Ala Ile Pro His Leu Thr Thr Ser Glu
        755   760   765

39

```
Met Asp Phe Cys Ile Glu Leu Gly Asn Lys Arg Trp Gln Phe Asn Arg
    770             775             780

Gln Ser Gly Phe Leu Ser Gln Met Trp Ile Gly Asp Lys Lys Gln Leu
785             790             795             800

Leu Thr Pro Leu Arg Asp Gln Phe Thr Arg Ala Pro Leu Asp Asn Asp
                805   .             810             815

Ile Gly Val Ser Glu Ala Thr Arg Ile Asp Pro Asn Ala Trp Val Glu
            820             825             830

Arg Trp Lys Ala Ala Gly His Tyr Gln Ala Glu Ala Ala Leu Leu Gln
        835             840             845

Cys Thr Ala Asp Thr Leu Ala Asp Ala Val Leu Ile Thr Thr Ala His
    850             855             860

Ala Trp Gln His Gln Gly Lys Thr Leu Phe Ile Ser Arg Lys Thr Tyr
865             870   .             875             880

Arg Ile Asp Gly Ser Gly Gln Met Ala Ile Thr Val Asp Val Glu Val
            885             890             895

Ala Ser Asp Thr Pro His Pro Ala Arg Ile Gly Leu Asn Cys Gln Leu
            900             905             910

Ala Gln Val Ala Glu Arg Val Asn Trp Leu Gly Leu Gly Pro Gln Glu
        915             920             .925

Asn Tyr Pro Asp Arg Leu Thr Ala Ala Cys Phe Asp Arg Trp Asp Leu
    930             935             940

Pro Leu Ser Asp Met Tyr Thr Pro Tyr Val Phe Pro Ser Glu Asn Gly
945             950             955 ·             960

Leu Arg Cys Gly Thr Arg Glu Leu Asn Tyr Gly Pro His Gln Trp Arg
            965             970             975

Gly Asp Phe Gln Phe Asn Ile Ser Arg Tyr Ser Gln Gln Leu Met
        980             985             990

Ser His Arg His Leu Leu His Ala  Glu Glu Gly Thr Trp  Leu Asn Ile
    995             1000             1005

Asp Gly  Phe His Met Gly Ile  Gly Gly Asp Asp Ser  Trp Ser Pro
    1010             1015             1020
```

```
Ser Val  Ser Ala Glu Leu Gln  Leu Ser Ala Gly Arg  Tyr His Tyr
    1025            1030                1035


Gln Leu  Val Trp Cys Gln Lys
    1040            1045



<210>  25
<211>  238
<212>  PRT
<213>  enhanced green fluorescence protein (eGFP)

<400>  25

Met Ser Lys Gly Glu Glu Leu Phe Thr Gly Val Val Pro Ile Leu Val
1               5               10              15


Glu Leu Asp Gly Asp Val Asn Gly His Lys Phe Ser Val Ser Gly Glu
        20              25              30


Gly Glu Gly Asp Ala Thr Tyr Gly Lys Leu Thr Leu Lys Phe Ile Cys
        35              40              45


Thr Thr Gly Lys Leu Pro Val Pro Trp Pro Thr Leu Val Thr Thr Phe
    50              55              60


Gly Tyr Gly Val Gln Cys Phe Ala Arg Tyr Pro Asp His Met Lys Gln
65              70              75              80


His Asp Phe Phe Lys Ser Ala Met Pro Glu Gly Tyr Val Gln Glu Arg
            85              90              95


Thr Ile Phe Phe Lys Asp Asp Gly Asn Tyr Lys Thr Arg Ala Glu Val
            100             105             110


Lys Phe Glu Gly Asp Thr Leu Val Asn Arg Ile Glu Leu Lys Gly Ile
        115             120             125


Asp Phe Lys Glu Asp Gly Asn Ile Leu Gly His Lys Leu Glu Tyr Asn
        130             135             140


Tyr Asn Ser His Asn Val Tyr Ile Met Ala Asp Lys Gln Lys Asn Gly
145             150             155             160


Ile Lys Val Asn Phe Lys Ile Arg His Asn Ile Glu Asp Gly Ser Val
                165             170             175


Gln Leu Ala Asp His Tyr Gln Gln Asn Thr Pro Ile Gly Asp Gly Pro
            180             185             190
```

41

```
Val Leu Leu Pro Asp Asn His Tyr Leu Ser Thr Gln Ser Ala Leu Ser
      195             200             205

Lys Asp Pro Asn Glu Lys Arg Asp His Met Val Leu Leu Glu Phe Val
      210             215             220  ·

Thr Ala Ala Gly Ile Thr His Gly Met Asp Glu Leu Tyr Lys
225             230             235
```

```
<210>  26
<211>  264
<212>  PRT
<213>  yellow fluorescent protein
```

```
<400>  26
```

```
Met Asp Gly Thr Glu Leu Gly Ser Thr Arg Asp Ser Arg Gly Ser Gly
1               5               10              15

Gly Ser Gly Gly Ser Gly Gly Ser Gly Met Val Ser Lys Gly Glu Glu
          20              25              30

Leu Phe Thr Gly Val Val Pro Ile Leu Val Glu Leu Asp Gly Asp Val
      35              40              45

Asn Gly His Lys Phe Ser Val Ser Gly Glu Gly Glu Gly Asp Ala Thr
      50              55              60

Tyr Gly Lys Leu Thr Leu Lys Phe Ile Cys Thr Thr Gly Lys Leu Pro
65              70              75              80

Val Pro Trp Pro Thr Leu Val Thr Thr Phe Gly Tyr Gly Leu Gln Cys
              85              90              95

Phe Ala Arg Tyr Pro Asp His Met Lys Gln His Asp Phe Phe Lys Ser
          100             105             110

Ala Met Pro Glu Gly Tyr Val Gln Glu Arg Thr Ile Phe Phe Lys Asp
          115             120             125

Asp Gly Asn Tyr Lys Thr Arg Ala Glu Val Lys Phe Glu Gly Asp Thr
      130             135             140

Leu Val Asn Arg Ile Glu Leu Lys Gly Ile Asp Phe Lys Glu Asp Gly
145             150             155             160

Asn Ile Leu Gly His Lys Leu Glu Tyr Asn Tyr Asn Ser His Asn Val
              165             170             175
```

42

Tyr Ile Met Ala Asp Lys Gln Lys Asn Gly Ile Lys Val Asn Phe Lys
            180   185   190

Ile Arg His Asn Ile Glu Asp Gly Ser Val Gln Leu Ala Asp His Tyr
            195   200   205

Gln Gln Asn Thr Pro Ile Gly Asp Gly Pro Val Leu Leu Pro Asp Asn
    210   215   220

His Tyr Leu Ser Tyr Gln Ser Ala Leu Ser Lys Asp Pro Asn Glu Lys
225   230   235   240

Arg Asp His Met Val Leu Leu Glu Phe Val Thr Ala Ala Gly Ile Thr
            245   250   255

Leu Gly Met Asp Glu Leu Tyr Lys
            260

<210> 27
<211> 238
<212> PRT
<213> soluble modified blue fluorescent protein

<400> 27

Met Ser Lys Gly Glu Glu Leu Phe Thr Gly Val Val Pro Ile Leu Val
1   5   10   15

Glu Leu Asp Gly Asp Val Asn Gly His Lys Phe Ser Val Ser Gly Glu
            20   25   30

Gly Glu Gly Asp Ala Thr Tyr Gly Lys Leu Thr Leu Lys Phe Ile Cys
            35   40   45

Thr Thr Gly Lys Leu Pro Val Pro Trp Pro Thr Leu Val Thr Thr Phe
    50   55   60

Ser His Gly Val Gln Cys Phe Ser Arg Tyr Pro Asp His Met Lys Arg
65   70   75   80

His Asp Phe Phe Lys Ser Ala Met Pro Glu Gly Tyr Val Gln Glu Arg
            85   90   95

Thr Ile Ser Phe Lys Asp Asp Gly Asn Tyr Lys Thr Arg Ala Glu Val
            100   105   110

Lys Phe Glu Gly Asp Thr Leu Val Asn Arg Ile Glu Leu Lys Gly Ile
            115   120   125

43

```
Asp Phe Lys Glu Asp Gly Asn Ile Leu Gly His Lys Leu Glu Tyr Asn
    130             135             140

Tyr Asn Ser His Asn Val Tyr Ile Thr Ala Asp Lys Gln Lys Asn Gly
145             150             155             160

Ile Lys Ala Asn Phe Lys Ile Arg His Asn Ile Glu Asp Gly Ser Val
            165             170             175

Gln Leu Ala Asp His Tyr Gln Gln Asn Thr Pro Ile Gly Asp Gly Pro
            180             185             190

Val Leu Leu Pro Asp Asn His Tyr Leu Ser Thr Gln Ser Ala Leu Ser
        195             200             205

Lys Asp Pro Asn Glu Lys Arg Asp His Met Val Leu Leu Glu Phe Val
    210             215             220

Thr Ala Ala Gly Ile Thr His Gly Met Asp Glu Leu Tyr Lys
225             230             235
```

```
<210>  28
<211>  238
<212>  PRT
<213>  soluble-modified red-shifted green fluorescent protein

<400>  28
```

```
Met Ser Lys Gly Glu Glu Leu Phe Thr Gly Val Val Pro Ile Leu Val
1           5               10              15

Glu Leu Asp Gly Asp Val Asn Gly His Lys Phe Ser Val Ser Gly Glu
            20              25              30

Gly Glu Gly Asp Ala Thr Tyr Gly Lys Leu Thr Leu Lys Phe Ile Cys
        35              40              45

Thr Thr Gly Lys Leu Pro Val Pro Trp Pro Thr Leu Val Thr Thr Phe
    50              55              60

Thr Tyr Gly Val Gln Cys Phe Ser Arg Tyr Pro Asp His Met Lys Arg
65              70              75              80

His Asp Phe Phe Lys Ser Ala Met Pro Glu Gly Tyr Val Gln Glu Arg
            85              90              95

Thr Ile Ser Phe Lys Asp Asp Gly Asn Tyr Lys Thr Arg Ala Glu Val
            100             105             110
```

44

```
Lys Phe Glu Gly Asp Thr Leu Val Asn Arg Ile Glu Leu Lys Gly Ile
        115                 120                 125

Asp Phe Lys Glu Asp Gly Asn Ile Leu Gly His Lys Leu Glu Tyr Asn
    130                 135                 140

Tyr Asn Ser His Asn Val Tyr Ile Thr Ala Asp Lys Gln Lys Asn Gly
145                 150                 155                 160

Ile Lys Ala Asn Phe Lys Ile Arg His Asn Ile Glu Asp Gly Ser Val
            165                 170                 175

Gln Leu Ala Asp His Tyr Gln Gln Asn Thr Pro Ile Gly Asp Gly Pro
        180                 185                 190

Val Leu Leu Pro Asp Asn His Tyr Leu Ser Thr Gln Ser Ala Leu Ser
        195                 200                 205

Lys Asp Pro Asn Glu Lys Arg Asp His Met Val Leu Leu Glu Phe Val
    210                 215                 220

Thr Ala Ala Gly Ile Thr His Gly Met Asp Glu Leu Tyr Lys
225                 230                 235
```

```
<210>  29
<211>  262
<212>  PRT
<213>  cyan fluorescent protein

<400>  29
```

```
Met His His His His His His Asp Gly Thr Met Val Ser Lys Gly
1               5                   10                  15

Glu Glu Leu Phe Thr Gly Val Val Pro Ile Leu Val Glu Leu Asp Gly
        20              25                  30

Asp Val Asn Gly His Lys Phe Ser Val Ser Gly Glu Gly Glu Gly Asp
        35              40                  45

Ala Thr Tyr Gly Lys Leu Thr Leu Lys Phe Ile Cys Thr Thr Gly Lys
    50              55                  60

Leu Pro Val Pro Trp Pro Thr Leu Val Thr Thr Leu Thr Trp Gly Val
65              70                  75                  80

Gln Cys Phe Ser Arg Tyr Pro Asp His Met Lys Gln His Asp Phe Phe
            85                  90                  95
```

```
Lys Ser Ala Met Pro Glu Gly Tyr Val Gln Glu Arg Thr Ile Phe Phe
            100             ·         105             110


Lys Asp Asp Gly Asn Tyr Lys Thr Arg Ala Glu Val Lys Phe Glu Gly
            115             120             125


Asp Thr Leu Val Asn Arg Ile Glu Leu Lys Gly Ile Asp Phe Lys Glu
    130             135             140


Asp Gly Asn Ile Leu Gly His Lys Leu Glu Tyr Asn Tyr Ile Ser His
145             150             155             160


Asn Val Tyr Ile Thr Ala Asp Lys Gln Lys Asn Gly Ile Lys Ala Asn
            165             170             175


Phe Lys Ile Arg His Asn Ile Glu Asp Gly Ser Val Gln Leu Ala Asp
            180             185             190


His Tyr Gln Gln Asn Thr Pro Ile Gly Asp Gly Pro Val Leu Leu Pro
            195             200             205


Asp Asn His Tyr Leu Ser Thr Gln Ser Ala Leu Ser Lys Asp Pro Asn
    210             215             220


Glu Lys Arg Asp His Met Val Leu Leu Glu Phe Val Thr Ala Ala Gly
225             230             235             240


Ile Thr Leu Gly Met Asp Glu Leu Tyr Ser Gly Ser Gly Ser Gly Ser
            245             250             255


Leu Glu Gly Thr Glu Leu
            260


<210>   30
<211>   8
<212>   PRT
<213>   streptavidin binding sequence

<400>   30

Trp Ser His Pro Gln Phe Glu Lys
1               5


<210>   31
<211>   574
<212>   PRT
<213>   strepsolysin-O

<400>   31
```

46

```
Met Lys Asp Met Ser Asn Lys Lys Thr Phe Lys Lys Tyr Ser Arg Val
1               5               10              15

Ala Gly Leu Leu Thr Ala Ala Leu Ile Ile Gly Asn Leu Val Thr Ala
            20              25              30

Asn Ala Glu Ser Asn Lys Gln Asn Thr Ala Ser Thr Glu Thr Thr Thr
        35              40              45

Thr Asn Glu Gln Pro Lys Pro Glu Ser Ser Glu Leu Thr Thr Glu Lys
    50              55              60

Ala Gly Gln Lys Thr Asp Asp Met Leu Asn Ser Asn Asp Met Ile Lys
65              70              75              80

Leu Ala Pro Lys Glu Met Pro Leu Glu Ser Ala Glu Lys Glu Glu Lys
            85              90              95

Lys Ser Glu Asp Lys Lys Lys Ser Glu Glu Asp His Thr Glu Glu Ile
        100             105             110

Asn Asp Lys Ile Tyr Ser Leu Asn Tyr Asn Glu Leu Glu Val Leu Ala
        115             120             125

Lys Asn Gly Glu Thr Ile Glu Asn Phe Val Pro Lys Glu Gly Val Lys
    130             135             140

Lys Ala Asp Lys Phe Ile Val Ile Glu Arg Lys Lys Lys Asn Ile Asn
145             150             155             160

Thr Thr Pro Val Asp Ile Ser Ile Ile Asp Ser Val Thr Asp Arg Thr
            165             170             175

Tyr Pro Ala Ala Leu Gln Leu Ala Asn Lys Gly Phe Thr Glu Asn Lys
        180             185             190

Pro Asp Ala Val Val Thr Lys Arg Asn Pro Gln Lys Ile His Ile Asp
        195             200             205

Leu Pro Gly Met Gly Asp Lys Ala Thr Val Glu Val Asn Asp Pro Thr
    210             215             220

Tyr Ala Asn Val Ser Thr Ala Ile Asp Asn Leu Val Asn Gln Trp His
225             230             235             240

Asp Asn Tyr Ser Gly Gly Asn Thr Leu Pro Ala Arg Thr Gln Tyr Thr
            245             250             255
```

47

```
Glu Ser Met Val Tyr Ser Lys Ser Gln Ile Glu Ala Ala Leu Asn Val
        260             265             270


Asn Ser Lys Ile Leu Asp Gly Thr Leu Gly Ile Asp Phe Lys Ser Ile
        275             280             285


Ser Lys Gly Glu Lys Lys Val Met Ile Ala Ala Tyr Lys Gln Ile Phe
    290             295             300


Tyr Thr Val Ser Ala Asn Leu Pro Asn Asn Pro Ala Asp Val Phe Asp
305             310             315             320


Lys Ser Val Thr Phe Lys Glu Leu Gln Arg Lys Gly Val Ser Asn Glu
        325             330             335


Ala Pro Pro Leu Phe Val Ser Asn Val Ala Tyr Gly Arg Thr Val Phe
        340             345             350


Val Lys Leu Glu Thr Ser Ser Lys Ser Asn Asp Val Glu Ala Ala Phe
        355             360             365


Ser Ala Ala Leu Lys Gly Thr Asp Val Lys Thr Asn Gly Lys Tyr Ser
    370             375             380


Asp Ile Leu Glu Asn Ser Ser Phe Thr Ala Val Val Leu Gly Gly Asp
385             390             395             400


Ala Ala Glu His Asn Lys Val Val Thr Lys Asp Phe Asp Val Ile Arg
            405             410             415


Asn Val Ile Lys Asp Asn Ala Thr Phe Ser Arg Lys Asn Pro Ala Tyr
        420             425             430


Pro Ile Ser Tyr Thr Ser Val Phe Leu Lys Asn Asn Lys Ile Ala Gly
        435             440             445


Val Asn Asn Arg Thr Glu Tyr Val Glu Thr Thr Ser Thr Glu Tyr Thr
    450             455             460


Ser Gly Lys Ile Asn Leu Ser His Arg Gly Ala Tyr Val Ala Gln Tyr
465             470             475             480


Glu Ile Leu Trp Asp Glu Ile Asn Tyr Asp Asp Lys Gly Lys Glu Val
            485             490             495


Ile Thr Lys Arg Arg Trp Asp Asn Asn Trp Tyr Ser Lys Thr Ser Pro
```

```
                500                    505                    510


        Phe Ser Thr Val Ile Pro Leu Gly Ala Asn Ser Arg Asn Ile Arg Ile
            515                 520                 525


        Met Ala Arg Glu Cys Thr Gly Leu Ala Trp Glu Trp Trp Arg Lys Val
            530                 535                 540


        Ile Asp Glu Arg Asp Val Lys Leu Ser Lys Glu Ile Asn Val Asn Ile
        545                 550                 555                 560


        Ser Gly Ser Thr Leu Ser Pro Tyr Gly Ser Ile Thr Tyr Lys
                        565                 570


        <210>   32
        <211>   293
        <212>   PRT
        <213>   alpha-hemolysin

        <400>   32

        Ala Asp Ser Asp Ile Asn Ile Lys Thr Gly Thr Thr Asp Ile Gly Ser
        1                   5                   10                  15


        Asn Thr Thr Val Lys Thr Gly Asp Leu Val Thr Tyr Asp Lys Glu Asn
                        20                  25                  30


        Gly Met His Lys Lys Val Phe Tyr Ser Phe Ile Asp Asp Lys Asn His
                    35                  40                  45


        Asn Lys Lys Leu Leu Val Ile Arg Thr Lys Gly Thr Ile Ala Gly Gln
            50                  55                  60


        Tyr Arg Val Tyr Ser Glu Glu Gly Ala Asn Lys Ser Gly Leu Ala Trp
        65                  70                  75                  80


        Pro Ser Ala Phe Lys Val Gln Leu Gln Leu Pro Asp Asn Glu Val Ala
                        85                  90                  95


        Gln Ile Ser Asp Tyr Tyr Pro Arg Asn Ser Ile Asp Thr Lys Glu Tyr
                    100                 105                 110


        Met Ser Thr Leu Thr Tyr Gly Phe Asn Gly Asn Val Thr Gly Asp Asp
                    115                 120                 125


        Thr Gly Lys Ile Gly Gly Leu Ile Gly Ala Asn Val Ser Ile Gly His
            130                 135                 140


        Thr Leu Lys Tyr Val Gln Pro Asp Phe Lys Thr Ile Leu Glu Ser Pro
```

145   150   155   160

Thr Asp Lys Lys Val Gly Trp Lys Val Ile Phe Asn Asn Met Val Asn
                165   170   175

Gln Asn Trp Gly Pro Tyr Asp Arg Asp Ser Trp Asn Pro Val Tyr Gly
            180   185   190

Asn Gln Leu Phe Met Lys Thr Arg Asn Gly Ser Met Lys Ala Ala Asp
            195   200   205

Asn Phe Leu Asp Pro Asn Lys Ala Ser Ser Leu Leu Ser Ser Gly Phe
    210   215   220

Ser Pro Asp Phe Ala Thr Val Ile Thr Met Asp Arg Lys Ala Ser Lys
225   230   235   240

Gln Gln Thr Asn Ile Asp Val Ile Tyr Glu Arg Val Arg Asp Asp Tyr
                245   250   255

Gln Leu His Trp Thr Ser Thr Asn Trp Lys Gly Thr Asn Thr Lys Asp
            260   265   270

Lys Trp Thr Asp Arg Ser Ser Glu Arg Tyr Lys Ile Asp Trp Glu Lys
            275   280   285

Glu Glu Met Thr Asn
        290

<210> 33
<211> 527
<212> PRT
<213> tetanolysin-O

<400> 33

Met Asn Lys Asn Val Leu Lys Phe Val Ser Arg Ser Leu Leu Ile Phe
1   5   10   15

Ser Met Thr Gly Leu Ile Ser Asn Tyr Asn Ser Ser Asn Val Leu Ala
            20   25   30

Lys Gly Asn Val Glu Glu His Ser Leu Ile Asn Asn Gly Gln Val Val
            35   40   45

Thr Ser Asn Thr Lys Cys Asn Leu Ala Lys Asp Asn Ser Ser Asp Ile
    50   55   60

Asp Lys Asn Ile Tyr Gly Leu Ser Tyr Asp Pro Arg Lys Ile Leu Ser

50

65   70   75   80

Tyr Asn Gly Glu Gln Val Glu Asn Phe Val Pro Ala Glu Gly Phe Glu
            85   90   95

Asn Pro Asp Lys Phe Ile Val Val Lys Arg Glu Lys Lys Ser Ile Ser
            100   105   110

Asp Ser Thr Ala Asp Ile Ser Ile Ile Asp Ser Ile Asn Asp Arg Thr
            115   120   125

Tyr Pro Gly Ala Ile Gln Leu Ala Asn Arg Asn Leu Met Glu Asn Lys
    130   135   140

Pro Asp Ile Ile Ser Cys Glu Arg Lys Pro Ile Thr Ile Ser Val Asp
145   150   155   160

Leu Pro Gly Met Ala Glu Asp Gly Lys Lys Val Val Asn Ser Pro Thr
            165   170   175

Tyr Ser Ser Val Asn Ser Ala Ile Asn Ser Ile Leu Asp Thr Trp Asn
            180   185   190

Ser Lys Tyr Ser Ser Lys Tyr Thr Ile Pro Thr Arg Met Ser Tyr Ser
            195   200   205

Asp Thr Met Val Tyr Ser Gln Ser Gln Leu Ser Ala Ala Val Gly Cys
    210   215   220

Asn Phe Lys Ala Leu Asn Lys Ala Leu Asn Ile Asp Phe Asp Ser Ile
225   230   235   240

Phe Lys Gly Glu Lys Lys Val Met Leu Leu Ala Tyr Lys Gln Ile Phe
            245   250   255

Tyr Thr Val Ser Val Asp Pro Pro Asn Arg Pro Ser Asp Leu Phe Gly
            260   265   270

Asp Ser Val Thr Phe Asp Glu Leu Ala Leu Lys Gly Ile Asn Asn Asn
            275   280   285

Asn Pro Pro Ala Tyr Val Ser Asn Val Ala Tyr Gly Arg Thr Ile Tyr
    290   295   300

Val Lys Leu Glu Thr Thr Ser Lys Ser Ser His Val Lys Ala Ala Phe
305   310   315   320

51

Lys Ala Leu Ile Asn Asn Gln Asp Ile Ser Ser Asn Ala Glu Tyr Lys
            325   330   335

Asp Ile Leu Asn Gln Ser Ser Phe Thr Ala Thr Val Leu Gly Gly Gly
            340   345   350

Ala Gln Glu His Asn Lys Ile Ile Thr Lys Asp Phe Asp Glu Ile Arg
            355   360   365

Asn Ile Ile Lys Asn Asn Ser Val Tyr Ser Pro Gln Asn Pro Gly Tyr
    370   375   380

Pro Ile Ser Tyr Thr Thr Thr Phe Leu Lys Asp Asn Ser Ile Ala Ser
385   390   395   400

Val Asn Asn Lys Thr Glu Tyr Ile Glu Thr Thr Ala Thr Glu Tyr Thr
            405   410   415

Asn Gly Lys Ile Val Leu Asp His Ser Gly Ala Tyr Val Ala Gln Phe
            420   425   430

Gln Val Thr Trp Asp Glu Val Ser Tyr Asp Glu Lys Gly Asn Glu Ile
            435   440   445

Val Glu His Lys Ala Trp Glu Gly Asn Asn Arg Asp Arg Thr Ala His
    450   455   460

Phe Asn Thr Glu Ile Tyr Leu Lys Gly Asn Ala Arg Asn Ile Ser Val
465   470   475   480

Lys Ile Arg Glu Cys Thr Gly Leu Ala Trp Glu Trp Trp Arg Thr Ile
            485   490   495

Val Asp Val Lys Asn Ile Pro Leu Ala Lys Glu Arg Thr Phe Tyr Ile
            500   505   510

Trp Gly Thr Thr Leu Tyr Pro Lys Thr Ser Ile Glu Thr Lys Met
    515   520   525

<210>   34
<211>   6129
<212>   DNA
<213>   Cystic Fibrosis Transmembrane   Conductance Regulator (CFTR)

<220>
<221>   CDS
<222>   (133)..(4575)
<223>

<400>   34

52

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aattggaagc aaatgacatc acagcaggtc agagaaaaag ggttgagcgg caggcaccca    60

gagtagtagg tctttggcat taggagcttg agcccagacg gccctagcag ggaccccagc   120

gcccgagaga cc atg cag agg tcg cct ctg gaa aag gcc agc gtt gtc tcc   171
              Met Gln Arg Ser Pro Leu Glu Lys Ala Ser Val Val Ser
              1               5                  10

aaa ctt ttt ttc agc tgg acc aga cca att ttg agg aaa gga tac aga    219
Lys Leu Phe Phe Ser Trp Thr Arg Pro Ile Leu Arg Lys Gly Tyr Arg
    15              20              25

cag cgc ctg gaa ttg tca gac ata tac caa atc cct tct gtt gat tct    267
Gln Arg Leu Glu Leu Ser Asp Ile Tyr Gln Ile Pro Ser Val Asp Ser
30              35              40              45

gct gac aat cta tct gaa aaa ttg gaa aga gaa tgg gat aga gag ctg    315
Ala Asp Asn Leu Ser Glu Lys Leu Glu Arg Glu Trp Asp Arg Glu Leu
            50              55              60

gct tca aag aaa aat cct aaa ctc att aat gcc ctt cgg cga tgt ttt    363
Ala Ser Lys Lys Asn Pro Lys Leu Ile Asn Ala Leu Arg Arg Cys Phe
            65              70              75

ttc tgg aga ttt atg ttc tat gga atc ttt tta tat tta ggg gaa gtc    411
Phe Trp Arg Phe Met Phe Tyr Gly Ile Phe Leu Tyr Leu Gly Glu Val
        80              85              90

acc aaa gca gta cag cct ctc tta ctg gga aga atc ata gct tcc tat    459
Thr Lys Ala Val Gln Pro Leu Leu Leu Gly Arg Ile Ile Ala Ser Tyr
        95              100             105

gac ccg gat aac aag gag gaa cgc tct atc gcg att tat cta ggc ata    507
Asp Pro Asp Asn Lys Glu Glu Arg Ser Ile Ala Ile Tyr Leu Gly Ile
110             115             120             125

ggc tta tgc ctt ctc ttt att gtg agg aca ctg ctc cta cac cca gcc    555
Gly Leu Cys Leu Leu Phe Ile Val Arg Thr Leu Leu Leu His Pro Ala
            130             135             140

att ttt ggc ctt cat cac att gga atg cag atg aga ata gct atg ttt    603
Ile Phe Gly Leu His His Ile Gly Met Gln Met Arg Ile Ala Met Phe
            145             150             155

agt ttg att tat aag aag act tta aag ctg tca agc cgt gtt cta gat    651
Ser Leu Ile Tyr Lys Lys Thr Leu Lys Leu Ser Ser Arg Val Leu Asp
            160             165             170

aaa ata agt att gga caa ctt gtt agt ctc ctt tcc aac aac ctg aac    699
Lys Ile Ser Ile Gly Gln Leu Val Ser Leu Leu Ser Asn Asn Leu Asn
            175             180             185

aaa ttt gat gaa gga ctt gca ttg gca cat ttc gtg tgg atc gct cct    747
Lys Phe Asp Glu Gly Leu Ala Leu Ala His Phe Val Trp Ile Ala Pro
190             195             200             205

ttg caa gtg gca ctc ctc atg ggg cta atc tgg gag ttg tta cag gcg    795
Leu Gln Val Ala Leu Leu Met Gly Leu Ile Trp Glu Leu Leu Gln Ala
            210             215             220

tct gcc ttc tgt gga ctt ggt ttc ctg ata gtc ctt gcc ctt ttt cag    843
Ser Ala Phe Cys Gly Leu Gly Phe Leu Ile Val Leu Ala Leu Phe Gln
            225             230             235
```

```
gct ggg cta ggg aga atg atg atg aag tac aga gat cag aga gct ggg        891
Ala Gly Leu Gly Arg Met Met Met Lys Tyr Arg Asp Gln Arg Ala Gly
            240              245              250

aag atc agt gaa aga ctt gtg att acc tca gaa atg att gaa aat atc        939
Lys Ile Ser Glu Arg Leu Val Ile Thr Ser Glu Met Ile Glu Asn Ile
        255              260              265

caa tct gtt aag gca tac tgc tgg gaa gaa gca atg gaa aaa atg att        987
Gln Ser Val Lys Ala Tyr Cys Trp Glu Glu Ala Met Glu Lys Met Ile
270              275              280              285

gaa aac tta aga caa aca gaa ctg aaa ctg act cgg aag gca gcc tat       1035
Glu Asn Leu Arg Gln Thr Glu Leu Lys Leu Thr Arg Lys Ala Ala Tyr
                290              295              300

gtg aga tac ttc aat agc tca gcc ttc ttc ttc tca ggg ttc ttt gtg      1083
Val Arg Tyr Phe Asn Ser Ser Ala Phe Phe Phe Ser Gly Phe Phe Val
            305              310              315

gtg ttt tta tct gtg ctt ccc tat gca cta atc aaa gga atc atc ctc      1131
Val Phe Leu Ser Val Leu Pro Tyr Ala Leu Ile Lys Gly Ile Ile Leu
            320              325              330

cgg aaa ata ttc acc acc atc tca ttc tgc att gtt ctg cgc atg gcg      1179
Arg Lys Ile Phe Thr Thr Ile Ser Phe Cys Ile Val Leu Arg Met Ala
        335              340              345

gtc act cgg caa ttt ccc tgg gct gta caa aca tgg tat gac tct ctt      1227
Val Thr Arg Gln Phe Pro Trp Ala Val Gln Thr Trp Tyr Asp Ser Leu
350              355              360              365

gga gca ata aac aaa ata cag gat ttc tta caa aag caa gaa tat aag      1275
Gly Ala Ile Asn Lys Ile Gln Asp Phe Leu Gln Lys Gln Glu Tyr Lys
                370              375              380

aca ttg gaa tat aac tta acg act aca gaa gta gtg atg gag aat gta      1323
Thr Leu Glu Tyr Asn Leu Thr Thr Thr Glu Val Val Met Glu Asn Val
            385              390              395

aca gcc ttc tgg gag gag gga ttt ggg gaa tta ttt gag aaa gca aaa      1371
Thr Ala Phe Trp Glu Glu Gly Phe Gly Glu Leu Phe Glu Lys Ala Lys
            400              405              410

caa aac aat aac aat aga aaa act tct aat ggt gat gac agc ctc ttc      1419
Gln Asn Asn Asn Asn Arg Lys Thr Ser Asn Gly Asp Asp Ser Leu Phe
415              420              425

ttc agt aat ttc tca ctt ctt ggt act cct gtc ctg aaa gat att aat      1467
Phe Ser Asn Phe Ser Leu Leu Gly Thr Pro Val Leu Lys Asp Ile Asn
430              435              440              445

ttc aag ata gaa aga gga cag ttg ttg gcg gtt gct gga tcc act gga      1515
Phe Lys Ile Glu Arg Gly Gln Leu Leu Ala Val Ala Gly Ser Thr Gly
                450              455              460

gca ggc aag act tca ctt cta atg atg att atg gga gaa ctg gag cct      1563
Ala Gly Lys Thr Ser Leu Leu Met Met Ile Met Gly Glu Leu Glu Pro
            465              470              475

tca gag ggt aaa att aag cac agt gga aga att tca ttc tgt tct cag      1611
Ser Glu Gly Lys Ile Lys His Ser Gly Arg Ile Ser Phe Cys Ser Gln
```

```
                480                   485                   490

ttt tcc tgg att atg cct ggc acc att aaa gaa aat atc atc ttt ggt          1659
Phe Ser Trp Ile Met Pro Gly Thr Ile Lys Glu Asn Ile Ile Phe Gly
    495                   500                   505

gtt tcc tat gat gaa tat aga tac aga agc gtc atc aaa gca tgc caa          1707
Val Ser Tyr Asp Glu Tyr Arg Tyr Arg Ser Val Ile Lys Ala Cys Gln
510                   515                   520                   525

cta gaa gag gac atc tcc aag ttt gca gag aaa gac aat ata gtt ctt          1755
Leu Glu Glu Asp Ile Ser Lys Phe Ala Glu Lys Asp Asn Ile Val Leu
                  530                   535                   540

gga gaa ggt gga atc aca ctg agt gga ggt caa cga gca aga att tct          1803
Gly Glu Gly Gly Ile Thr Leu Ser Gly Gly Gln Arg Ala Arg Ile Ser
                  545                   550                   555

tta gca aga gca gta tac aaa gat gct gat ttg tat tta tta gac tct          1851
Leu Ala Arg Ala Val Tyr Lys Asp Ala Asp Leu Tyr Leu Leu Asp Ser
        560                   565                   570

cct ttt gga tac cta gat gtt tta aca gaa aaa gaa ata ttt gaa agc          1899
Pro Phe Gly Tyr Leu Asp Val Leu Thr Glu Lys Glu Ile Phe Glu Ser
        575                   580                   585

tgt gtc tgt aaa ctg atg gct aac aaa act agg att ttg gtc act tct          1947
Cys Val Cys Lys Leu Met Ala Asn Lys Thr Arg Ile Leu Val Thr Ser
590                   595                   600                   605

aaa atg gaa cat tta aag aaa gct gac aaa ata tta att ttg aat gaa          1995
Lys Met Glu His Leu Lys Lys Ala Asp Lys Ile Leu Ile Leu Asn Glu
                  610                   615                   620

ggt agc agc tat ttt tat ggg aca ttt tca gaa ctc caa aat cta cag          2043
Gly Ser Ser Tyr Phe Tyr Gly Thr Phe Ser Glu Leu Gln Asn Leu Gln
                  625                   630                   635

cca gac ttt agc tca aaa ctc atg gga tgt gat tct ttc gac caa ttt          2091
Pro Asp Phe Ser Ser Lys Leu Met Gly Cys Asp Ser Phe Asp Gln Phe
                  640                   645                   650

agt gca gaa aga aga aat tca atc cta act gag acc tta cac cgt ttc          2139
Ser Ala Glu Arg Arg Asn Ser Ile Leu Thr Glu Thr Leu His Arg Phe
        655                   660                   665

tca tta gaa gga gat gct cct gtc tcc tgg aca gaa aca aaa aaa caa          2187
Ser Leu Glu Gly Asp Ala Pro Val Ser Trp Thr Glu Thr Lys Lys Gln
670                   675                   680                   685

tct ttt aaa cag act gga gag ttt ggg gaa aaa agg aag aat tct att          2235
Ser Phe Lys Gln Thr Gly Glu Phe Gly Glu Lys Arg Lys Asn Ser Ile
                  690                   695                   700

ctc aat cca atc aac tct ata cga aaa ttt tcc att gtg caa aag act          2283
Leu Asn Pro Ile Asn Ser Ile Arg Lys Phe Ser Ile Val Gln Lys Thr
                  705                   710                   715

ccc tta caa atg aat ggc atc gaa gag gat tct gat gag cct tta gag          2331
Pro Leu Gln Met Asn Gly Ile Glu Glu Asp Ser Asp Glu Pro Leu Glu
                  720                   725                   730

aga agg ctg tcc tta gta cca gat tct gag cag gga gag gcg ata ctg          2379
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Arg Arg Leu Ser Leu Val Pro Asp Ser Glu Gln Gly Glu Ala Ile Leu
    735                 740             745

cct cgc atc agc gtg atc agc act ggc ccc acg ctt cag gca cga agg      2427
Pro Arg Ile Ser Val Ile Ser Thr Gly Pro Thr Leu Gln Ala Arg Arg
750                 755             760             765

agg cag tct gtc ctg aac ctg atg aca cac tca gtt aac caa ggt cag      2475
Arg Gln Ser Val Leu Asn Leu Met Thr His Ser Val Asn Gln Gly Gln
                770             775             780

aac att cac cga aag aca aca gca tcc aca cga aaa gtg tca ctg gcc      2523
Asn Ile His Arg Lys Thr Thr Ala Ser Thr Arg Lys Val Ser Leu Ala
            785             790             795

cct cag gca aac ttg act gaa ctg gat ata tat tca aga agg tta tct      2571
Pro Gln Ala Asn Leu Thr Glu Leu Asp Ile Tyr Ser Arg Arg Leu Ser
        800             805             810

caa gaa act ggc ttg gaa ata agt gaa gaa att aac gaa gaa gac tta      2619
Gln Glu Thr Gly Leu Glu Ile Ser Glu Glu Ile Asn Glu Glu Asp Leu
    815             820             825

aag gag tgc ctt ttt gat gat atg gag agc ata cca gca gtg act aca      2667
Lys Glu Cys Leu Phe Asp Asp Met Glu Ser Ile Pro Ala Val Thr Thr
830             835             840             845

tgg aac aca tac ctt cga tat att act gtc cac aag agc tta att ttt      2715
Trp Asn Thr Tyr Leu Arg Tyr Ile Thr Val His Lys Ser Leu Ile Phe
                850             855             860

gtg cta att tgg tgc tta gta att ttt ctg gca gag gtg gct gct tct      2763
Val Leu Ile Trp Cys Leu Val Ile Phe Leu Ala Glu Val Ala Ala Ser
            865             870             875

ttg gtt gtg ctg tgg ctc ctt gga aac act cct ctt caa gac aaa ggg      2811
Leu Val Val Leu Trp Leu Leu Gly Asn Thr Pro Leu Gln Asp Lys Gly
            880             885             890

aat agt act cat agt aga aat aac agc tat gca gtg att atc acc agc      2859
Asn Ser Thr His Ser Arg Asn Asn Ser Tyr Ala Val Ile Ile Thr Ser
    895             900             905

acc agt tcg tat tat gtg ttt tac att tac gtg gga gta gcc gac act      2907
Thr Ser Ser Tyr Tyr Val Phe Tyr Ile Tyr Val Gly Val Ala Asp Thr
910             915             920             925

ttg ctt gct atg gga ttc ttc aga ggt cta cca ctg gtg cat act cta      2955
Leu Leu Ala Met Gly Phe Phe Arg Gly Leu Pro Leu Val His Thr Leu
                930             935             940

atc aca gtg tcg aaa att tta cac cac aaa atg tta cat tct gtt ctt      3003
Ile Thr Val Ser Lys Ile Leu His His Lys Met Leu His Ser Val Leu
            945             950             955

caa gca cct atg tca acc ctc aac acg ttg aaa gca ggt ggg att ctt      3051
Gln Ala Pro Met Ser Thr Leu Asn Thr Leu Lys Ala Gly Gly Ile Leu
        960             965             970

aat aga ttc tcc aaa gat ata gca att ttg gat gac ctt ctg cct ctt      3099
Asn Arg Phe Ser Lys Asp Ile Ala Ile Leu Asp Asp Leu Leu Pro Leu
    975             980             985
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56

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acc ata ttt gac ttc atc cag ttg tta tta att   gtg att gga gct ata      3147
Thr Ile Phe Asp Phe Ile Gln Leu Leu Leu Ile   Val Ile Gly Ala Ile
990                 995                 1000                  1005


gca gtt gtc gca gtt  tta caa ccc tac atc  ttt gtt gca aca gtg          3192
Ala Val Val Ala Val  Leu Gln Pro Tyr Ile  Phe Val Ala Thr Val
                1010                 1015                 1020


cca gtg ata gtg gct  ttt att atg ttg aga  gca tat ttc ctc caa          3237
Pro Val Ile Val Ala  Phe Ile Met Leu Arg  Ala Tyr Phe Leu Gln
                1025                 1030                 1035


acc tca cag caa ctc  aaa caa ctg gaa tct  gaa ggc agg agt cca          3282
Thr Ser Gln Gln Leu  Lys Gln Leu Glu Ser  Glu Gly Arg Ser Pro
                1040                 1045                 1050


att ttc act cat ctt  gtt aca agc tta aaa  gga cta tgg aca ctt          3327
Ile Phe Thr His Leu  Val Thr Ser Leu Lys  Gly Leu Trp Thr Leu
                1055                 1060                 1065


cgt gcc ttc gga cgg  cag cct tac ttt gaa  act ctg ttc cac aaa          3372
Arg Ala Phe Gly Arg  Gln Pro Tyr Phe Glu  Thr Leu Phe His Lys
                1070                 1075                 1080


gct ctg aat tta cat  act gcc aac tgg ttc  ttg tac ctg tca aca          3417
Ala Leu Asn Leu His  Thr Ala Asn Trp Phe  Leu Tyr Leu Ser Thr
                1085                 1090                 1095


ctg cgc tgg ttc caa  atg aga ata gaa atg  att ttt gtc atc ttc          3462
Leu Arg Trp Phe Gln  Met Arg Ile Glu Met  Ile Phe Val Ile Phe
                1100                 1105                 1110


ttc att gct gtt acc  ttc att tcc att tta  aca aca gga gaa gga          3507
Phe Ile Ala Val Thr  Phe Ile Ser Ile Leu  Thr Thr Gly Glu Gly
                1115                 1120                 1125


gaa gga aga gtt ggt  att atc ctg act tta  gcc atg aat atc atg          3552
Glu Gly Arg Val Gly  Ile Ile Leu Thr Leu  Ala Met Asn Ile Met
                1130                 1135                 1140


agt aca ttg cag tgg  gct gta aac tcc agc  ata gat gtg gat agc          3597
Ser Thr Leu Gln Trp  Ala Val Asn Ser Ser  Ile Asp Val Asp Ser
                1145                 1150                 1155


ttg atg cga tct gtg  agc cga gtc ttt aag  ttc att gac atg cca          3642
Leu Met Arg Ser Val  Ser Arg Val Phe Lys  Phe Ile Asp Met Pro
                1160                 1165                 1170


aca gaa ggt aaa cct  acc aag tca acc aaa  cca tac aag aat ggc          3687
Thr Glu Gly Lys Pro  Thr Lys Ser Thr Lys  Pro Tyr Lys Asn Gly
                1175                 1180                 1185


caa ctc tcg aaa gtt  atg att att gag aat  tca cac gtg aag aaa          3732
Gln Leu Ser Lys Val  Met Ile Ile Glu Asn  Ser His Val Lys Lys
                1190                 1195                 1200


gat gac atc tgg ccc  tca ggg ggc caa atg  act gtc aaa gat ctc          3777
Asp Asp Ile Trp Pro  Ser Gly Gly Gln Met  Thr Val Lys Asp Leu
                1205                 1210                 1215


aca gca aaa tac aca  gaa ggt gga aat gcc  ata tta gag aac att          3822
Thr Ala Lys Tyr Thr  Glu Gly Gly Asn Ala  Ile Leu Glu Asn Ile
                1220                 1225                 1230
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57

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tcc ttc tca ata agt   cct ggc cag agg gtg   ggc ctc ttg gga aga        3867
Ser Phe Ser Ile Ser   Pro Gly Gln Arg Val   Gly Leu Leu Gly Arg
                1235                    1240                    1245

act gga tca ggg aag   agt act ttg tta tca   gct ttt ttg aga cta        3912
Thr Gly Ser Gly Lys   Ser Thr Leu Leu Ser   Ala Phe Leu Arg Leu
                1250                    1255                    1260

ctg aac act gaa gga   gaa atc cag atc gat   ggt gtg tct tgg gat        3957
Leu Asn Thr Glu Gly   Glu Ile Gln Ile Asp   Gly Val Ser Trp Asp
                1265                    1270                    1275

tca ata act ttg caa   cag tgg agg aaa gcc   ttt gga gtg ata cca        4002
Ser Ile Thr Leu Gln   Gln Trp Arg Lys Ala   Phe Gly Val Ile Pro
                1280                    1285                    1290

cag aaa gta ttt att   ttt tct gga aca ttt   aga aaa aac ttg gat        4047
Gln Lys Val Phe Ile   Phe Ser Gly Thr Phe   Arg Lys Asn Leu Asp
                1295                    1300                    1305

ccc tat gaa cag tgg   agt gat caa gaa ata   tgg aaa gtt gca gat        4092
Pro Tyr Glu Gln Trp   Ser Asp Gln Glu Ile   Trp Lys Val Ala Asp
                1310                    1315                    1320

gag gtt ggg ctc aga   tct gtg ata gaa cag   ttt cct ggg aag ctt        4137
Glu Val Gly Leu Arg   Ser Val Ile Glu Gln   Phe Pro Gly Lys Leu
                1325                    1330                    1335

gac ttt gtc ctt gtg   gat ggg ggc tgt gtc   cta agc cat ggc cac        4182
Asp Phe Val Leu Val   Asp Gly Gly Cys Val   Leu Ser His Gly His
                1340                    1345                    1350

aag cag ttg atg tgc   ttg gct aga tct gtt   ctc agt aag gcg aag        4227
Lys Gln Leu Met Cys   Leu Ala Arg Ser Val   Leu Ser Lys Ala Lys
                1355                    1360                    1365

atc ttg ctg ctt gat   gaa ccc agt gct cat   ttg gat cca gta aca        4272
Ile Leu Leu Leu Asp   Glu Pro Ser Ala His   Leu Asp Pro Val Thr
                1370                    1375                    1380

tac caa ata att aga   aga act cta aaa caa   gca ttt gct gat tgc        4317
Tyr Gln Ile Ile Arg   Arg Thr Leu Lys Gln   Ala Phe Ala Asp Cys
                1385                    1390                    1395

aca gta att ctc tgt   gaa cac agg ata gaa   gca atg ctg gaa tgc        4362
Thr Val Ile Leu Cys   Glu His Arg Ile Glu   Ala Met Leu Glu Cys
                1400                    1405                    1410

caa caa ttt ttg gtc   ata gaa gag aac aaa   gtg cgg cag tac gat        4407
Gln Gln Phe Leu Val   Ile Glu Glu Asn Lys   Val Arg Gln Tyr Asp
                1415                    1420                    1425

tcc atc cag aaa ctg   ctg aac gag agg agc   ctc ttc cgg caa gcc        4452
Ser Ile Gln Lys Leu   Leu Asn Glu Arg Ser   Leu Phe Arg Gln Ala
                1430                    1435                    1440

atc agc ccc tcc gac   agg gtg aag ctc ttt   ccc cac cgg aac tca        4497
Ile Ser Pro Ser Asp   Arg Val Lys Leu Phe   Pro His Arg Asn Ser
                1445                    1450                    1455

agc aag tgc aag tct   aag ccc cag att gct   gct ctg aaa gag gag        4542
Ser Lys Cys Lys Ser   Lys Pro Gln Ile Ala   Ala Leu Lys Glu Glu
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58

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                1460              1465              1470
aca gaa gaa gag gtg  caa gat aca agg ctt  tag agagcagcat              4585
Thr Glu Glu Glu Val  Gln Asp Thr Arg Leu
                1475              1480

aaatgttgac atgggacatt tgctcatgga attggagctc gtgggacagt cacctcatgg      4645

aattggagct cgtggaacag ttacctctgc ctcagaaaac aaggatgaat taagtttttt      4705

tttaaaaaag aaacatttgg taaggggaat tgaggacact gatatgggtc ttgataaatg      4765

gcttcctggc aatagtcaaa ttgtgtgaaa ggtacttcaa atccttgaag atttaccact      4825

tgtgttttgc aagccagatt ttcctgaaaa cccttgccat gtgctagtaa ttggaaaggc      4885

agctctaaat gtcaatcagc ctagttgatc agcttattgt ctagtgaaac tcgttaattt      4945

gtagtgttgg agaagaactg aaatcatact tcttagggtt atgattaagt aatgataact      5005

ggaaacttca gcggtttata taagcttgta ttcctttttc tctcctctcc ccatgatgtt      5065

tagaaacaca actatattgt ttgctaagca ttccaactat ctcatttcca agcaagtatt      5125

agaataccac aggaaccaca agactgcaca tcaaaatatg ccccattcaa catctagtga      5185

gcagtcagga aagagaactt ccagatcctg gaaatcaggg ttagtattgt ccaggtctac      5245

caaaaatctc aatatttcag ataatcacaa tacatccctt acctgggaaa gggctgttat      5305

aatctttcac aggggacagg atggttccct tgatgaagaa gttgatatgc cttttcccaa      5365

ctccagaaag tgacaagctc acagaccttt gaactagagt ttagctggaa aagtatgtta      5425

gtgcaaattg tcacaggaca gcccttcttt ccacagaagc tccaggtaga gggtgtgtaa      5485

gtagataggc catggcact gtgggtagac acacatgaag tccaagcatt tagatgtata      5545

ggttgatggt ggtatgtttt caggctagat gtatgtactt catgctgtct acactaagag      5605

agaatgagag acacactgaa gaagcaccaa tcatgaatta gttttatatg cttctgtttt      5665

ataattttgt gaagcaaaat tttttctcta ggaaatattt attttaataa tgtttcaaac      5725

atatattaca atgctgtatt ttaaaagaat gattatgaat tacatttgta taaaataatt      5785

tttatatttg aaatattgac tttttatggc actagtattt ttatgaaata ttatgttaaa      5845

actgggacag gggagaacct agggtgatat taaccagggg ccatgaatca cctttttggtc     5905

tggagggaag ccttggggct gatcgagttg ttgcccacag ctgtatgatt cccagccaga      5965

cacagcctct tagatgcagt tctgaagaag atggtaccac cagtctgact gtttccatca      6025

agggtacact gccttctcaa ctccaaactg actcttaaga agactgcatt atatttatta      6085

ctgtaagaaa atatcacttg tcaataaaat ccatacattt gtgt                       6129
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<210> 35
<211> 1480
<212> PRT
<213> Cystic Fibrosis Transmembrane Conductance Regulator (CFTR)

59

<400> 35

Met Gln Arg Ser Pro Leu Glu Lys Ala Ser Val Val Ser Lys Leu Phe
1   5   10   15

Phe Ser Trp Thr Arg Pro Ile Leu Arg Lys Gly Tyr Arg Gln Arg Leu
            20   25   30

Glu Leu Ser Asp Ile Tyr Gln Ile Pro Ser Val Asp Ser Ala Asp Asn
        35   40   45

Leu Ser Glu Lys Leu Glu Arg Glu Trp Asp Arg Glu Leu Ala Ser Lys
    50   55   60

Lys Asn Pro Lys Leu Ile Asn Ala Leu Arg Arg Cys Phe Phe Trp Arg
65   70   75   80

Phe Met Phe Tyr Gly Ile Phe Leu Tyr Leu Gly Glu Val Thr Lys Ala
                85   90   95

Val Gln Pro Leu Leu Leu Gly Arg Ile Ile Ala Ser Tyr Asp Pro Asp
            100   105   110

Asn Lys Glu Glu Arg Ser Ile Ala Ile Tyr Leu Gly Ile Gly Leu Cys
        115   120   125

Leu Leu Phe Ile Val Arg Thr Leu Leu Leu His Pro Ala Ile Phe Gly
    130   135   140

Leu His His Ile Gly Met Gln Met Arg Ile Ala Met Phe Ser Leu Ile
145   150   155   160

Tyr Lys Lys Thr Leu Lys Leu Ser Ser Arg Val Leu Asp Lys Ile Ser
                165   170   175

Ile Gly Gln Leu Val Ser Leu Leu Ser Asn Asn Leu Asn Lys Phe Asp
            180   185   190

Glu Gly Leu Ala Leu Ala His Phe Val Trp Ile Ala Pro Leu Gln Val
        195   200   205

Ala Leu Leu Met Gly Leu Ile Trp Glu Leu Leu Gln Ala Ser Ala Phe
    210   215   220

Cys Gly Leu Gly Phe Leu Ile Val Leu Ala Leu Phe Gln Ala Gly Leu
225   230   235   240

60

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Gly Arg Met Met Met Lys Tyr Arg Asp Gln Arg Ala Gly Lys Ile Ser
              245                 250                 255


Glu Arg Leu Val Ile Thr Ser Glu Met Ile Glu Asn Ile Gln Ser Val
          260                 265                 270


Lys Ala Tyr Cys Trp Glu Glu Ala Met Glu Lys Met Ile Glu Asn Leu
          275                 280                 285


Arg Gln Thr Glu Leu Lys Leu Thr Arg Lys Ala Ala Tyr Val Arg Tyr
      290                 295                 300


Phe Asn Ser Ser Ala Phe Phe Phe Ser Gly Phe Phe Val Val Phe Leu
305                 310                 315                 320


Ser Val Leu Pro Tyr Ala Leu Ile Lys Gly Ile Ile Leu Arg Lys Ile
              325                 330                 335


Phe Thr Thr Ile Ser Phe Cys Ile Val Leu Arg Met Ala Val Thr Arg
              340                 345                 350


Gln Phe Pro Trp Ala Val Gln Thr Trp Tyr Asp Ser Leu Gly Ala Ile
          355                 360                 365


Asn Lys Ile Gln Asp Phe Leu Gln Lys Gln Glu Tyr Lys Thr Leu Glu
      370                 375                 380


Tyr Asn Leu Thr Thr Thr Glu Val Val Met Glu Asn Val Thr Ala Phe
385                 390                 395                 400


Trp Glu Glu Gly Phe Gly Glu Leu Phe Glu Lys Ala Lys Gln Asn Asn
                  405                 410                 415


Asn Asn Arg Lys Thr Ser Asn Gly Asp Asp Ser Leu Phe Phe Ser Asn
              420                 425                 430


Phe Ser Leu Leu Gly Thr Pro Val Leu Lys Asp Ile Asn Phe Lys Ile
          435                 440                 445


Glu Arg Gly Gln Leu Leu Ala Val Ala Gly Ser Thr Gly Ala Gly Lys
      450                 455                 460


Thr Ser Leu Leu Met Met Ile Met Gly Glu Leu Glu Pro Ser Glu Gly
465                 470                 475                 480


Lys Ile Lys His Ser Gly Arg Ile Ser Phe Cys Ser Gln Phe Ser Trp
              485                 490                 495
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Ile Met Pro Gly Thr Ile Lys Glu Asn Ile Ile Phe Gly Val Ser Tyr
        500   505   510

Asp Glu Tyr Arg Tyr Arg Ser Val Ile Lys Ala Cys Gln Leu Glu Glu
        515   520   525

Asp Ile Ser Lys Phe Ala Glu Lys Asp Asn Ile Val Leu Gly Glu Gly
        530   535   540

Gly Ile Thr Leu Ser Gly Gly Gln Arg Ala Arg Ile Ser Leu Ala Arg
545   550   555   560

Ala Val Tyr Lys Asp Ala Asp Leu Tyr Leu Leu Asp Ser Pro Phe Gly
                565   570   575

Tyr Leu Asp Val Leu Thr Glu Lys Glu Ile Phe Glu Ser Cys Val Cys
                580   585   590

Lys Leu Met Ala Asn Lys Thr Arg Ile Leu Val Thr Ser Lys Met Glu
        595   600   605

His Leu Lys Lys Ala Asp Lys Ile Leu Ile Leu Asn Glu Gly Ser Ser
        610   615   620

Tyr Phe Tyr Gly Thr Phe Ser Glu Leu Gln Asn Leu Gln Pro Asp Phe
625   630   635   640

Ser Ser Lys Leu Met Gly Cys Asp Ser Phe Asp Gln Phe Ser Ala Glu
                645   650   655

Arg Arg Asn Ser Ile Leu Thr Glu Thr Leu His Arg Phe Ser Leu Glu
                660   665   670

Gly Asp Ala Pro Val Ser Trp Thr Glu Thr Lys Lys Gln Ser Phe Lys
        675   680   685

Gln Thr Gly Glu Phe Gly Glu Lys Arg Lys Asn Ser Ile Leu Asn Pro
        690   695   700

Ile Asn Ser Ile Arg Lys Phe Ser Ile Val Gln Lys Thr Pro Leu Gln
705   710   715   720

Met Asn Gly Ile Glu Glu Asp Ser Asp Glu Pro Leu Glu Arg Arg Leu
                725   730   735

Ser Leu Val Pro Asp Ser Glu Gln Gly Glu Ala Ile Leu Pro Arg Ile
                740   745   750

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Ser Val Ile Ser Thr Gly Pro Thr Leu Gln Ala Arg Arg Arg Gln Ser
        755                 760                 765


Val Leu Asn Leu Met Thr His Ser Val Asn Gln Gly Gln Asn Ile His
    770                 775                 780


Arg Lys Thr Thr Ala Ser Thr Arg Lys Val Ser Leu Ala Pro Gln Ala
785                 790                 795                 800


Asn Leu Thr Glu Leu Asp Ile Tyr Ser Arg Arg Leu Ser Gln Glu Thr
                805   .             810                 815


Gly Leu Glu Ile Ser Glu Glu Ile Asn Glu Glu Asp Leu Lys Glu Cys
            820                 825                 830


Leu Phe Asp Asp Met Glu Ser Ile Pro Ala Val Thr Thr Trp Asn Thr
        835                 840                 845


Tyr Leu Arg Tyr Ile Thr Val His Lys Ser Leu Ile Phe Val Leu Ile
    850                 855                 860


Trp Cys Leu Val Ile Phe Leu Ala Glu Val Ala Ala Ser Leu Val Val
865                 870                 875                 880


Leu Trp Leu Leu Gly Asn Thr Pro Leu Gln Asp Lys Gly Asn Ser Thr
                885                 890                 895


His Ser Arg Asn Asn Ser Tyr Ala Val Ile Ile Thr Ser Thr Ser Ser
            900                 905                 910


Tyr Tyr Val Phe Tyr Ile Tyr Val Gly Val Ala Asp Thr Leu Leu Ala
        915                 920                 925


Met Gly Phe Phe Arg Gly Leu Pro Leu Val His Thr Leu Ile Thr Val
    930                 935                 940


Ser Lys Ile Leu His His Lys Met Leu His Ser Val Leu Gln Ala Pro
945                 950                 955                 960


Met Ser Thr Leu Asn Thr Leu Lys Ala Gly Gly Ile Leu Asn Arg Phe
                965                 970                 975


Ser Lys Asp Ile Ala Ile Leu Asp Asp Leu Leu Pro Leu Thr Ile Phe
            980                 985                 990


Asp Phe Ile Gln Leu Leu Leu Ile  Val Ile Gly Ala Ile  Ala Val Val
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            995                 1000                1005


    Ala Val  Leu Gln Pro Tyr Ile  Phe Val Ala Thr Val  Pro Val Ile
        1010                1015                1020


    Val Ala  Phe Ile Met Leu Arg  Ala Tyr Phe Leu Gln  Thr Ser Gln
        1025                1030                1035


    Gln Leu  Lys Gln Leu Glu Ser  Glu Gly Arg Ser Pro  Ile Phe Thr
        1040                1045                1050


    His Leu  Val Thr Ser Leu Lys  Gly Leu Trp Thr Leu  Arg Ala Phe
        1055                1060                1065


    Gly Arg  Gln Pro Tyr Phe Glu  Thr Leu Phe His Lys  Ala Leu Asn
        1070                1075                1080


    Leu His  Thr Ala Asn Trp Phe  Leu Tyr Leu Ser Thr  Leu Arg Trp
        1085                1090                1095


    Phe Gln  Met Arg Ile Glu Met  Ile Phe Val Ile Phe  Phe Ile Ala
        1100                1105                1110


    Val Thr  Phe Ile Ser Ile Leu  Thr Thr Gly Glu Gly  Glu Gly Arg
        1115                1120                1125


    Val Gly  Ile Ile Leu Thr Leu  Ala Met Asn Ile Met  Ser Thr Leu
        1130                1135                1140


    Gln Trp  Ala Val Asn Ser Ser  Ile Asp Val Asp Ser  Leu Met Arg
        1145                1150                1155


    Ser Val  Ser Arg Val Phe Lys  Phe Ile Asp Met Pro  Thr Glu Gly
        1160                1165                1170


    Lys Pro  Thr Lys Ser Thr Lys  Pro Tyr Lys Asn Gly  Gln Leu Ser
        1175                1180                1185


    Lys Val  Met Ile Ile Glu Asn  Ser His Val Lys Lys  Asp Asp Ile
        1190                1195                1200


    Trp Pro  Ser Gly Gly Gln Met  Thr Val Lys Asp Leu  Thr Ala Lys
        1205                1210                1215


    Tyr Thr  Glu Gly Gly Asn Ala  Ile Leu Glu Asn Ile  Ser Phe Ser
        1220                1225                1230
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64

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Ile Ser Pro Gly Gln Arg Val Gly Leu Leu Gly Arg Thr Gly Ser
    1235                1240                1245


Gly Lys Ser Thr Leu Leu Ser Ala Phe Leu Arg Leu Leu Asn Thr
    1250                1255                1260


Glu Gly Glu Ile Gln Ile Asp Gly Val Ser Trp Asp Ser Ile Thr
    1265                1270                1275


Leu Gln Gln Trp Arg Lys Ala Phe Gly Val Ile Pro Gln Lys Val
    1280                1285                1290


Phe Ile Phe Ser Gly Thr Phe Arg Lys Asn Leu Asp Pro Tyr Glu
    1295                1300                1305


Gln Trp Ser Asp Gln Glu Ile Trp Lys Val Ala Asp Glu Val Gly
    1310                1315                1320


Leu Arg Ser Val Ile Glu Gln Phe Pro Gly Lys Leu Asp Phe Val
    1325                1330                1335


Leu Val Asp Gly Gly Cys Val Leu Ser His Gly His Lys Gln Leu
    1340                1345                1350


Met Cys Leu Ala Arg Ser Val Leu Ser Lys Ala Lys Ile Leu Leu
    1355                1360                1365


Leu Asp Glu Pro Ser Ala His Leu Asp Pro Val Thr Tyr Gln Ile
    1370                1375                1380


Ile Arg Arg Thr Leu Lys Gln Ala Phe Ala Asp Cys Thr Val Ile
    1385                1390                1395


Leu Cys Glu His Arg Ile Glu Ala Met Leu Glu Cys Gln Gln Phe
    1400                1405                1410


Leu Val Ile Glu Glu Asn Lys Val Arg Gln Tyr Asp Ser Ile Gln
    1415                1420                1425


Lys Leu Leu Asn Glu Arg Ser Leu Phe Arg Gln Ala Ile Ser Pro
    1430                1435                1440


Ser Asp Arg Val Lys Leu Phe Pro His Arg Asn Ser Ser Lys Cys
    1445                1450                1455


Lys Ser Lys Pro Gln Ile Ala Ala Leu Lys Glu Glu Thr Glu Glu
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Glu Val  Gln Asp Thr Arg Leu
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act ggg acc ctg gtt ttc act gtc atc act gct gtg ctg ggt tcc ttc    104
Thr Gly Thr Leu Val Phe Thr Val Ile Thr Ala Val Leu Gly Ser Phe
         10          15              20

cag ttt gga tat gac att ggt gtg atc aat gca cct caa cag gta ata    152
Gln Phe Gly Tyr Asp Ile Gly Val Ile Asn Ala Pro Gln Gln Val Ile
        25              30              35

ata tct cac tat aga cat gtt ttg ggt gtt cca ctg gat gac cga aaa    200
Ile Ser His Tyr Arg His Val Leu Gly Val Pro Leu Asp Asp Arg Lys
    40              45              50

gct atc aac aac tat gtt atc aac agt aca gat gaa ctg ccc aca atc    248
Ala Ile Asn Asn Tyr Val Ile Asn Ser Thr Asp Glu Leu Pro Thr Ile
55              60              65              70

tca tac tca atg aac cca aaa cca acc cct tgg gct gag gaa gag act    296
Ser Tyr Ser Met Asn Pro Lys Pro Thr Pro Trp Ala Glu Glu Glu Thr
            75              80              85

gtg gca gct gct caa cta atc acc atg ctc tgg tcc ctg tct gta tcc    344
Val Ala Ala Ala Gln Leu Ile Thr Met Leu Trp Ser Leu Ser Val Ser
        90              95              100

agc ttt gca gtt ggt gga atg act gca tca ttc ttt ggt ggg tgg ctt    392
Ser Phe Ala Val Gly Gly Met Thr Ala Ser Phe Phe Gly Gly Trp Leu
        105             110             115

ggg gac aca ctt gga aga atc aaa gcc atg tta gta gca aac att ctg    440
Gly Asp Thr Leu Gly Arg Ile Lys Ala Met Leu Val Ala Asn Ile Leu
    120             125             130

tca tta gtt gga gct ctc ttg atg ggg ttt tca aaa ttg gga cca tct    488
Ser Leu Val Gly Ala Leu Leu Met Gly Phe Ser Lys Leu Gly Pro Ser
135             140             145             150

cat ata ctt ata att gct gga aga agc ata tca gga cta tat tgt ggg    536
His Ile Leu Ile Ile Ala Gly Arg Ser Ile Ser Gly Leu Tyr Cys Gly
            155             160             165

cta att tca ggc ctg gtt cct atg tat atc ggt gaa att gct cca acc    584
Leu Ile Ser Gly Leu Val Pro Met Tyr Ile Gly Glu Ile Ala Pro Thr
            170             175             180
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66

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gct ctc agg gga gca ctt ggc act ttt cat cag ctg gcc atc gtc acg        632
Ala Leu Arg Gly Ala Leu Gly Thr Phe His Gln Leu Ala Ile Val Thr
        185                     190                 195

ggc att ctt att agt cag att att ggt ctt gaa ttt atc ttg ggc aat        680
Gly Ile Leu Ile Ser Gln Ile Ile Gly Leu Glu Phe Ile Leu Gly Asn
        200                     205                 210

tat gat ctg tgg cac atc ctg ctt ggc ctg tct ggt gtg cga gcc atc        728
Tyr Asp Leu Trp His Ile Leu Leu Gly Leu Ser Gly Val Arg Ala Ile
215                     220                 225                 230

ctt cag tct ctg cta ctc ttt ttc tgt cca gaa agc ccc aga tac ctt        776
Leu Gln Ser Leu Leu Leu Phe Phe Cys Pro Glu Ser Pro Arg Tyr Leu
                235                 240                 245

tac atc aag tta gat gag gaa gtc aaa gca aaa caa agc ttg aaa aga        824
Tyr Ile Lys Leu Asp Glu Glu Val Lys Ala Lys Gln Ser Leu Lys Arg
            250                 255                 260

ctc aga gga tat gat gat gtc acc aaa gat att aat gaa atg aga aaa        872
Leu Arg Gly Tyr Asp Asp Val Thr Lys Asp Ile Asn Glu Met Arg Lys
        265                 270                 275

gaa aga gaa gaa gca tcg agt gag cag aaa gtc tct ata att cag ctc        920
Glu Arg Glu Glu Ala Ser Ser Glu Gln Lys Val Ser Ile Ile Gln Leu
        280                 285                 290

ttc acc aat tcc agc tac cga cag cct att cta gtg gca ctg atg ctg        968
Phe Thr Asn Ser Ser Tyr Arg Gln Pro Ile Leu Val Ala Leu Met Leu
295                     300                 305                 310

cat gtg gct cag caa ttt tcc gga atc aat ggc att ttt tac tac tca       1016
His Val Ala Gln Gln Phe Ser Gly Ile Asn Gly Ile Phe Tyr Tyr Ser
                315                 320                 325

acc agc att ttt cag acg gct ggt atc agc aaa cct gtt tat gca acc       1064
Thr Ser Ile Phe Gln Thr Ala Gly Ile Ser Lys Pro Val Tyr Ala Thr
                330                 335                 340

att gga gtt ggc gct gta aac atg gtt ttc act gct gtc tct gta ttc       1112
Ile Gly Val Gly Ala Val Asn Met Val Phe Thr Ala Val Ser Val Phe
                345                 350                 355

ctt gtg gag aag gca ggg cga cgt tct ctc ttt cta att gga atg agt       1160
Leu Val Glu Lys Ala Gly Arg Arg Ser Leu Phe Leu Ile Gly Met Ser
        360                 365                 370

ggg atg ttt gtt tgt gcc atc ttc atg tca gtg gga ctt gtg ctg ctg       1208
Gly Met Phe Val Cys Ala Ile Phe Met Ser Val Gly Leu Val Leu Leu
375                     380                 385                 390

aat aag ttc tct tgg atg agt tat gtg agc atg ata gcc atc ttc ctc       1256
Asn Lys Phe Ser Trp Met Ser Tyr Val Ser Met Ile Ala Ile Phe Leu
                395                 400                 405

ttt gtc agc ttc ttt gaa att ggg cca ggc ccg atc ccc tgg ttc atg       1304
Phe Val Ser Phe Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp Phe Met
                410                 415                 420

gtg gct gag ttt ttc agt caa gga cca cgt cct gct gct tta gca ata       1352
Val Ala Glu Phe Phe Ser Gln Gly Pro Arg Pro Ala Ala Leu Ala Ile
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                425                 430                 435

gct gca ttc agc aat tgg acc tgc aat ttc att gta gct ctg tgt ttc        1400
Ala Ala Phe Ser Asn Trp Thr Cys Asn Phe Ile Val Ala Leu Cys Phe
        440                 445                 450

cag tac att gcg gac ttc tgt gga cct tat gtg ttt ttc ctc ttt gct        1448
Gln Tyr Ile Ala Asp Phe Cys Gly Pro Tyr Val Phe Phe Leu Phe Ala
455                 460                 465                 470

gga gtg ctc ctg gcc ttt acc ctg ttc aca ttt ttt aaa gtt cca gaa        1496
Gly Val Leu Leu Ala Phe Thr Leu Phe Thr Phe Phe Lys Val Pro Glu
                475                 480                 485

acc aaa gga aag tct ttt gag gaa att gct gca gaa ttc caa aag aag        1544
Thr Lys Gly Lys Ser Phe Glu Glu Ile Ala Ala Glu Phe Gln Lys Lys
                490                 495                 500

agt ggc tca gcc cac agg cca aaa gct gct gta gaa atg aaa ttc cta        1592
Ser Gly Ser Ala His Arg Pro Lys Ala Ala Val Glu Met Lys Phe Leu
                505                 510                 515

gga gct aca gag act gtg taa aaaaaaaacc ctgcttttg acatgaacag          1643
Gly Ala Thr Glu Thr Val
                520

aaacaataag ggaaccgtct gttttaaat gatgattcct tgagcatttt atatccacat      1703

ctttaagtat tgttttattt ttatgtgctc tcatcagaaa tgtcatcaaa tattaccaaa     1763

aaagtatttt tttaagttag agaatatatt tttgatggta agactgtaat taagtaaacc     1823

aaaaaggcta gtttattttg ttacactaaa gggcaggtgg ttctaatatt tttagctctg     1883

ttctttataa caaggttctt ctaaaattga agagatttca acatatcatt tttttaacac     1943

ataactagaa acctgaggat gcaacaaata tttatatatt tgaatatcat taaattggaa     2003

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ggtatattac ctcaaattcc taataagttt gatcaaatct aatgtaagaa aatttgaagt     2543

aaaggattga tcactttgtt aaaaatattt tctgaattat tatgtctcaa aataagttga     2603

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attttacaat tatggaaata tagttctgat gggtcccaaa agcttagcag ggtgctaacg    2963

tatctctagg ctgttttctc caccaactgg agcactgatc aatccttctt atgtttgctt    3023

taatgtgtat tgaagaaaag cacttttttaa aaagtactct ttaagagtga aataattaaa    3083

aaccactgaa catttgcttt gtttctaaa gttgttcaca tatatgtaat ttagcagtcc    3143

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            20                 25                 30


Ala Pro Gln Gln Val Ile Ile Ser His Tyr Arg His Val Leu Gly Val
        35                 40                 45


Pro Leu Asp Asp Arg Lys Ala Ile Asn Asn Tyr Val Ile Asn Ser Thr
    50                 55                 60


Asp Glu Leu Pro Thr Ile Ser Tyr Ser Met Asn Pro Lys Pro Thr Pro
65                 70                 75                 80


Trp Ala Glu Glu Glu Thr Val Ala Ala Ala Gln Leu Ile Thr Met Leu
                85                 90                 95


Trp Ser Leu Ser Val Ser Ser Phe Ala Val Gly Gly Met Thr Ala Ser
            100                105                110


Phe Phe Gly Gly Trp Leu Gly Asp Thr Leu Gly Arg Ile Lys Ala Met
        115                120                125


Leu Val Ala Asn Ile Leu Ser Leu Val Gly Ala Leu Leu Met Gly Phe
    130                135                140


Ser Lys Leu Gly Pro Ser His Ile Leu Ile Ile Ala Gly Arg Ser Ile
145                150                155                160
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69

Ser Gly Leu Tyr Cys Gly Leu Ile Ser Gly Leu Val Pro Met Tyr Ile
              165   170   175

Gly Glu Ile Ala Pro Thr Ala Leu Arg Gly Ala Leu Gly Thr Phe His
          180   185   190

Gln Leu Ala Ile Val Thr Gly Ile Leu Ile Ser Gln Ile Ile Gly Leu
          195   200   205

Glu Phe Ile Leu Gly Asn Tyr Asp Leu Trp His Ile Leu Leu Gly Leu
    210   215   220

Ser Gly Val Arg Ala Ile Leu Gln Ser Leu Leu Leu Phe Phe Cys Pro
225   230   235   240

Glu Ser Pro Arg Tyr Leu Tyr Ile Lys Leu Asp Glu Glu Val Lys Ala
              245   250   255

Lys Gln Ser Leu Lys Arg Leu Arg Gly Tyr Asp Asp Val Thr Lys Asp
          260   265   270

Ile Asn Glu Met Arg Lys Glu Arg Glu Glu Ala Ser Ser Glu Gln Lys
    275   280   285

Val Ser Ile Ile Gln Leu Phe Thr Asn Ser Ser Tyr Arg Gln Pro Ile
    290   295   300

Leu Val Ala Leu Met Leu His Val Ala Gln Gln Phe Ser Gly Ile Asn
305   310   315   320

Gly Ile Phe Tyr Tyr Ser Thr Ser Ile Phe Gln Thr Ala Gly Ile Ser
              325   330   335

Lys Pro Val Tyr Ala Thr Ile Gly Val Gly Ala Val Asn Met Val Phe
              340   345   350

Thr Ala Val Ser Val Phe Leu Val Glu Lys Ala Gly Arg Arg Ser Leu
          355   360   365

Phe Leu Ile Gly Met Ser Gly Met Phe Val Cys Ala Ile Phe Met Ser
    370   375   380

Val Gly Leu Val Leu Leu Asn Lys Phe Ser Trp Met Ser Tyr Val Ser
385   390   395   400

Met Ile Ala Ile Phe Leu Phe Val Ser Phe Phe Glu Ile Gly Pro Gly
              405   410   415

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Pro Ile Pro Trp Phe Met Val Ala Glu Phe Phe Ser Gln Gly Pro Arg
        420             425             430

Pro Ala Ala Leu Ala Ile Ala Ala Phe Ser Asn Trp Thr Cys Asn Phe
        435             440             445

Ile Val Ala Leu Cys Phe Gln Tyr Ile Ala Asp Phe Cys Gly Pro Tyr
    450             455             460

Val Phe Phe Leu Phe Ala Gly Val Leu Leu Ala Phe Thr Leu Phe Thr
465             470             475             480

Phe Phe Lys Val Pro Glu Thr Lys Gly Lys Ser Phe Glu Glu Ile Ala
    .       485             490             495

Ala Glu Phe Gln Lys Lys Ser Gly Ser Ala His Arg Pro Lys Ala Ala
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Val Glu Met Lys Phe Leu Gly Ala Thr Glu Thr Val
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ttcctgagga cgtggagaaa actttctgct gagaaggaca ttttgaaggt tttgttggct     180

gaaaaagctg tttctggaat caccctaga tctttcttga agacttgaat tagattacag     240
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cg atg ggg aca cag aag gtc acc cca gct ctg ata ttt gcc atc aca       287
   Met Gly Thr Gln Lys Val Thr Pro Ala Leu Ile Phe Ala Ile Thr
   1               5               10              15

gtt gct aca atc ggc tct ttc caa ttt ggc tac aac act ggg gtc atc      335
Val Ala Thr Ile Gly Ser Phe Gln Phe Gly Tyr Asn Thr Gly Val Ile
               20              25              30

aat gct cct gag aag atc ata aag gaa ttt atc aat aaa act ttg acg      383
Asn Ala Pro Glu Lys Ile Ile Lys Glu Phe Ile Asn Lys Thr Leu Thr
           35              40      .       45

gac aag gga aat gcc cca ccc tct gag gtg ctg ctc acg tct ctc tgg      431
Asp Lys Gly Asn Ala Pro Pro Ser Glu Val Leu Leu Thr Ser Leu Trp
       50              55              60
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71

tcc ttg tct gtg gcc ata ttt tcc gtc ggg ggt atg atc ggc tcc ttt   479
Ser Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met Ile Gly Ser Phe
    65   70   75

tcc gtc gga ctc ttc gtc aac cgc ttt ggc agg cgc aat tca atg ctg   527
Ser Val Gly Leu Phe Val Asn Arg Phe Gly Arg Arg Asn Ser Met Leu
80   85   90   95

att gtc aac ctg ttg gct gtc act ggt ggc tgc ttt atg gga ctg tgt   575
Ile Val Asn Leu Leu Ala Val Thr Gly Gly Cys Phe Met Gly Leu Cys
                100   105   110

aaa gta gct aag tcg gtt gaa atg ctg atc ctg ggt cgc ttg gtt att   623
Lys Val Ala Lys Ser Val Glu Met Leu Ile Leu Gly Arg Leu Val Ile
            115   120   125

ggc ctc ttc tgc gga ctc tgc aca ggt ttt gtg ccc atg tac att gga   671
Gly Leu Phe Cys Gly Leu Cys Thr Gly Phe Val Pro Met Tyr Ile Gly
        130   135   140

gag atc tcg cct act gcc ctg cgg ggt gcc ttt ggc act ctc aac cag   719
Glu Ile Ser Pro Thr Ala Leu Arg Gly Ala Phe Gly Thr Leu Asn Gln
    145   150   155

ctg ggc atc gtt gtt gga att ctg gtg gcc cag atc ttt ggt ctg gaa   767
Leu Gly Ile Val Val Gly Ile Leu Val Ala Gln Ile Phe Gly Leu Glu
160   165   170   175

ttc atc ctt ggg tct gaa gag cta tgg ccg ctg cta ctg ggt ttt acc   815
Phe Ile Leu Gly Ser Glu Glu Leu Trp Pro Leu Leu Leu Gly Phe Thr
            180   185   190

atc ctt cct gct atc cta caa agt gca gcc ctt cca ttt tgc cct gaa   863
Ile Leu Pro Ala Ile Leu Gln Ser Ala Ala Leu Pro Phe Cys Pro Glu
            195   200   205

agt ccc aga ttt ttg ctc att aac aga aaa gaa gag gag aat gct aag   911
Ser Pro Arg Phe Leu Leu Ile Asn Arg Lys Glu Glu Glu Asn Ala Lys
        210   215   220

cag atc ctc cag cgg ttg tgg ggc acc cag gat gta tcc caa gac atc   959
Gln Ile Leu Gln Arg Leu Trp Gly Thr Gln Asp Val Ser Gln Asp Ile
    225   230   235

cag gag atg aaa gat gag agt gca agg atg tca caa gaa aag caa gtc   1007
Gln Glu Met Lys Asp Glu Ser Ala Arg Met Ser Gln Glu Lys Gln Val
240   245   250   255

acc gtg cta gag ctc ttt aga gtg tcc agc tac cga cag ccc atc atc   1055
Thr Val Leu Glu Leu Phe Arg Val Ser Ser Tyr Arg Gln Pro Ile Ile
            260   265   270

att tcc att gtg ctc cag ctc tct cag cag ctc tct ggg atc aat gct   1103
Ile Ser Ile Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala
        275   280   285

gtg ttc tat tac tca aca gga atc ttc aag gat gca ggt gtt caa gag   1151
Val Phe Tyr Tyr Ser Thr Gly Ile Phe Lys Asp Ala Gly Val Gln Glu
        290   295   300

ccc atc tat gcc acc atc ggc gcg ggt gtg gtt aat act atc ttc act   1199
Pro Ile Tyr Ala Thr Ile Gly Ala Gly Val Val Asn Thr Ile Phe Thr

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              305                 310                 315

gta gtt tct cta ttt ctg gtg gaa agg gca gga aga agg act ctg cat      1247
Val Val Ser Leu Phe Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His
320                 325                 330                 335

atg ata ggc ctt gga ggg atg gct ttt tgt tcc acg ctc atg act gtt      1295
Met Ile Gly Leu Gly Gly Met Ala Phe Cys Ser Thr Leu Met Thr Val
                    340                 345                 350

tct ttg tta tta aag gat aac tat aat ggg atg agc ttt gtc tgt att      1343
Ser Leu Leu Leu Lys Asp Asn Tyr Asn Gly Met Ser Phe Val Cys Ile
                355                 360                 365

ggg gct atc ttg gtc ttt gta gcc ttc ttt gaa att gga cca ggc ccc      1391
Gly Ala Ile Leu Val Phe Val Ala Phe Phe Glu Ile Gly Pro Gly Pro
            370                 375                 380

att ccc tgg ttt att gtg gcc gaa ctc ttc agc cag ggc ccc cgc cca      1439
Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro
            385                 390                 395

gct gcg atg gca gtg gcc ggc tgc tcc aac tgg acc tcc aac ttc cta      1487
Ala Ala Met Ala Val Ala Gly Cys Ser Asn Trp Thr Ser Asn Phe Leu
400                 405                 410                 415

gtc gga ttg ctc ttc ccc tcc gct gct cac tat tta gga gcc tac gtt      1535
Val Gly Leu Leu Phe Pro Ser Ala Ala His Tyr Leu Gly Ala Tyr Val
                    420                 425                 430

ttt att atc ttc acc ggc ttc ctc att acc ttc ttg gct ttt acc ttc      1583
Phe Ile Ile Phe Thr Gly Phe Leu Ile Thr Phe Leu Ala Phe Thr Phe
                435                 440                 445

ttc aaa gtc cct gag acc cgt ggc agg act ttt gag gat atc aca cgg      1631
Phe Lys Val Pro Glu Thr Arg Gly Arg Thr Phe Glu Asp Ile Thr Arg
                450                 455                 460

gcc ttt gaa ggg cag gca cac ggt gca gat aga tct gga aag gac ggc      1679
Ala Phe Glu Gly Gln Ala His Gly Ala Asp Arg Ser Gly Lys Asp Gly
                465                 470                 475

gtc atg gag atg aac agc atc gag cct gct aag gag acc acc acc aat      1727
Val Met Glu Met Asn Ser Ile Glu Pro Ala Lys Glu Thr Thr Thr Asn
480                 485                 490                 495

gtc taa gtcgtgcctc cttccacctc cctcccggca tgggaaagcc acctctccct      1783
Val
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caacaaggga gagacctcat caggatgaac ccaggacgct tctgaatgct gctacttaat   1843

tcctttctca tcccacgcac tccatgagca ccccaaggct gcggtttgtt ggatcttcaa   1903

tggctttta aatttattt cctggacatc ctcttctgct taggagagac cgagtgaacc   1963

taccttcatt tcaggaggga ttggccgctt ggcacatgac aactttgcca gcttttcctc   2023

ccttgggttc tgatattgcc gcactagggg atataggaga ggaaaagtaa ggtgcagttc   2083

ccccaacctc agacttacca ggaagcagat acatatgagt gtggaagccg gagggtgttt   2143

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73

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caacttcatg tcaactttct ggctcctcaa acagtaggtt ggcagtaagg cagggtccca   3823

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74

<213> GLUT3

<400> 39

Met Gly Thr Gln Lys Val Thr Pro Ala Leu Ile Phe Ala Ile Thr Val
1   5   10   15

Ala Thr Ile Gly Ser Phe Gln Phe Gly Tyr Asn Thr Gly Val Ile Asn
            20   25   30

Ala Pro Glu Lys Ile Ile Lys Glu Phe Ile Asn Lys Thr Leu Thr Asp
        35   40   45

Lys Gly Asn Ala Pro Pro Ser Glu Val Leu Leu Thr Ser Leu Trp Ser
    50   55   60

Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met Ile Gly Ser Phe Ser
65   70   75   80

Val Gly Leu Phe Val Asn Arg Phe Gly Arg Arg Asn Ser Met Leu Ile
                85   90   95

Val Asn Leu Leu Ala Val Thr Gly Gly Cys Phe Met Gly Leu Cys Lys
            100   105   110

Val Ala Lys Ser Val Glu Met Leu Ile Leu Gly Arg Leu Val Ile Gly
        115   120   125

Leu Phe Cys Gly Leu Cys Thr Gly Phe Val Pro Met Tyr Ile Gly Glu
    130   135   140

Ile Ser Pro Thr Ala Leu Arg Gly Ala Phe Gly Thr Leu Asn Gln Leu
145   150   155   160

Gly Ile Val Val Gly Ile Leu Val Ala Gln Ile Phe Gly Leu Glu Phe
                165   170   175

Ile Leu Gly Ser Glu Glu Leu Trp Pro Leu Leu Leu Gly Phe Thr Ile
            180   185   190

Leu Pro Ala Ile Leu Gln Ser Ala Ala Leu Pro Phe Cys Pro Glu Ser
    195   200   205

Pro Arg Phe Leu Leu Ile Asn Arg Lys Glu Glu Glu Asn Ala Lys Gln
    210   215   220

Ile Leu Gln Arg Leu Trp Gly Thr Gln Asp Val Ser Gln Asp Ile Gln
225   230   235   240

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Glu Met Lys Asp Glu Ser Ala Arg Met Ser Gln Glu Lys Gln Val Thr
            245             250             255

Val Leu Glu Leu Phe Arg Val Ser Ser Tyr Arg Gln Pro Ile Ile Ile
            260             265             270

Ser Ile Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val
            275             280             285

Phe Tyr Tyr Ser Thr Gly Ile Phe Lys Asp Ala Gly Val Gln Glu Pro
    290             295             300

Ile Tyr Ala Thr Ile Gly Ala Gly Val Val Asn Thr Ile Phe Thr Val
305             310             315             320

Val Ser Leu Phe Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His Met
            325             330             335

Ile Gly Leu Gly Gly Met Ala Phe Cys Ser Thr Leu Met Thr Val Ser
            340             345             350

Leu Leu Leu Lys Asp Asn Tyr Asn Gly Met Ser Phe Val Cys Ile Gly
    355             360             365

Ala Ile Leu Val Phe Val Ala Phe Phe Glu Ile Gly Pro Gly Pro Ile
    370             375             380

Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala
385             390             395             400

Ala Met Ala Val Ala Gly Cys Ser Asn Trp Thr Ser Asn Phe Leu Val
            405             410             415

Gly Leu Leu Phe Pro Ser Ala Ala His Tyr Leu Gly Ala Tyr Val Phe
            420             425             430

Ile Ile Phe Thr Gly Phe Leu Ile Thr Phe Leu Ala Phe Thr Phe Phe
            435             440             445

Lys Val Pro Glu Thr Arg Gly Arg Thr Phe Glu Asp Ile Thr Arg Ala
    450             455             460

Phe Glu Gly Gln Ala His Gly Ala Asp Arg Ser Gly Lys Asp Gly Val
465             470             475             480

Met Glu Met Asn Ser Ile Glu Pro Ala Lys Glu Thr Thr Thr Asn Val
            485             490             495
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<210>   40
<211>   2218
<212>   DNA
<213>   GLUT5

<220>
<221>   CDS
<222>   (1)..(1581)
<223>

<400>   40
ctt ctc tct cca ttc agt gca cgc gtt act ttg gct aaa agg agg tga        48
Leu Leu Ser Pro Phe Ser Ala Arg Val Thr Leu Ala Lys Arg Arg
1               5                   10                  15


gcg gca ctc tgc cct tcc aga gca agc atg gag caa cag gat cag agc        96
Ala Ala Leu Cys Pro Ser Arg Ala Ser Met Glu Gln Gln Asp Gln Ser
                20                  25                  30


atg aag gaa ggg agg ctg acg ctt gtg ctt gcc ctg gca acc ctg ata       144
Met Lys Glu Gly Arg Leu Thr Leu Val Leu Ala Leu Ala Thr Leu Ile
            35                  40                  45


gct gcc ttt ggg tca tcc ttc cag tat ggg tac aac gtg gct gct gtc       192
Ala Ala Phe Gly Ser Ser Phe Gln Tyr Gly Tyr Asn Val Ala Ala Val
            50                  55                  60


aac tcc cca gca ctg ctc atg caa caa ttt tac aat gag act tac tat       240
Asn Ser Pro Ala Leu Leu Met Gln Gln Phe Tyr Asn Glu Thr Tyr Tyr
        65                  70                  75


ggt agg acc ggt gaa ttc atg gaa gac ttc ccc ttg acg ttg ctg tgg       288
Gly Arg Thr Gly Glu Phe Met Glu Asp Phe Pro Leu Thr Leu Leu Trp
80                  85                  90                  95


tct gta acc gtg tcc atg ttt cca ttt gga ggg ttt atc gga tcc ctc       336
Ser Val Thr Val Ser Met Phe Pro Phe Gly Gly Phe Ile Gly Ser Leu
                100                 105                 110


ctg gtc ggc ccc ttg gtg aat aaa ttt ggc aga aaa ggg gcc ttg ctg       384
Leu Val Gly Pro Leu Val Asn Lys Phe Gly Arg Lys Gly Ala Leu Leu
                115                 120                 125


ttc aac aac ata ttt tct atc gtg cct gcg atc tta atg gga tgc agc       432
Phe Asn Asn Ile Phe Ser Ile Val Pro Ala Ile Leu Met Gly Cys Ser
            130                 135                 140


aga gtc gcc aca tca ttt gag ctt atc att att tcc aga ctt ttg gtg       480
Arg Val Ala Thr Ser Phe Glu Leu Ile Ile Ile Ser Arg Leu Leu Val
        145                 150                 155


gga ata tgt gca ggt gta tct tcc aac gtg gtc ccc atg tac tta ggg       528
Gly Ile Cys Ala Gly Val Ser Ser Asn Val Val Pro Met Tyr Leu Gly
160                 165                 170                 175


gag ctg gcc cct aaa aac ctg cgg ggg gct ctc ggg gtg gtg ccc cag       576
Glu Leu Ala Pro Lys Asn Leu Arg Gly Ala Leu Gly Val Val Pro Gln
                180                 185                 190


ctc ttc atc act gtt ggc atc ctt gtg gcc cag atc ttt ggt ctt cgg       624
Leu Phe Ile Thr Val Gly Ile Leu Val Ala Gln Ile Phe Gly Leu Arg
```

77

```
                    195                  200                  205

aat ctc ctt gca aac gta gat ggc tgg ccg atc ctg ctg ggg ctg acc          672
Asn Leu Leu Ala Asn Val Asp Gly Trp Pro Ile Leu Leu Gly Leu Thr
        210                  215                  220

ggg gtc ccc gcg gcg ctg cag ctc ctt ctg ctg ccc ttc ttc ccc gag          720
Gly Val Pro Ala Ala Leu Gln Leu Leu Leu Leu Pro Phe Phe Pro Glu
        225                  230                  235

agc ccc agg tac ctg ctg att cag aag aaa gac gaa gcg gcc gcc aag          768
Ser Pro Arg Tyr Leu Leu Ile Gln Lys Lys Asp Glu Ala Ala Ala Lys
240                  245                  250                  255

aaa gcc cta cag acg ctg cgc ggc tgg gac tct gtg gac agg gag gtg          816
Lys Ala Leu Gln Thr Leu Arg Gly Trp Asp Ser Val Asp Arg Glu Val
        260                  265                  270

gcc gag atc cgg cag gag gat gag gca gag aag gcc gcg ggc ttc atc          864
Ala Glu Ile Arg Gln Glu Asp Glu Ala Glu Lys Ala Ala Gly Phe Ile
        275                  280                  285

tcc gtg ctg aag ctg ttc cgg atg cgc tcg ctg cgc tgg cag ctg ctg          912
Ser Val Leu Lys Leu Phe Arg Met Arg Ser Leu Arg Trp Gln Leu Leu
        290                  295                  300

tcc atc atc gtc ctc atg ggc ggc cag cag ctg tcg ggc gtc aac gct          960
Ser Ile Ile Val Leu Met Gly Gly Gln Gln Leu Ser Gly Val Asn Ala
        305                  310                  315

atc tac tac tac gcg gac cag atc tac ctg agc gcc ggc gtg ccg gag          1008
Ile Tyr Tyr Tyr Ala Asp Gln Ile Tyr Leu Ser Ala Gly Val Pro Glu
320                  325                  330                  335

gag cac gtg cag tac gtg acg gcc ggc acc ggg gcc gtg aac gtg gtc          1056
Glu His Val Gln Tyr Val Thr Ala Gly Thr Gly Ala Val Asn Val Val
        340    .             345                  350

atg acc ttc tgc gcc gtg ttc gtg gtg gag ctc ctg ggt cgg agg ctg          1104
Met Thr Phe Cys Ala Val Phe Val Val Glu Leu Leu Gly Arg Arg Leu
        355                  360                  365

ctg ctg ctg ctg ggc ttc tcc atc tgc ctc ata gcc tgc tgc gtg ctc          1152
Leu Leu Leu Leu Gly Phe Ser Ile Cys Leu Ile Ala Cys Cys Val Leu
        370                  375                  380

act gca gct ctg gca ctg cag gac aca gtg tcc tgg atg cca tac atc          1200
Thr Ala Ala Leu Ala Leu Gln Asp Thr Val Ser Trp Met Pro Tyr Ile
        385                  390                  395

agc atc gtc tgt gtc atc tcc tac gtc ata gga cat gcc ctc ggg ccc          1248
Ser Ile Val Cys Val Ile Ser Tyr Val Ile Gly His Ala Leu Gly Pro
400                  405                  410    .             415

agt ccc ata ccc gcg ctg ctc atc act gag atc ttc ctg cag tcc tct          1296
Ser Pro Ile Pro Ala Leu Leu Ile Thr Glu Ile Phe Leu Gln Ser Ser
        420                  425                  .      430

cgg cca tct gcc ttc atg gtg ggg ggc agt gtg cac tgg ctc tcc aac          1344
Arg Pro Ser Ala Phe Met Val Gly Gly Ser Val His Trp Leu Ser Asn
        435                  440                  445

ttc acc gtg ggc ttg atc ttc ccg ttc atc cag gag ggc ctc ggc ccg          1392
```

78

```
Phe Thr Val Gly Leu Ile Phe Pro Phe Ile Gln Glu Gly Leu Gly Pro
    450             455             460

tac agc ttc att gtc ttc gcc gtg atc tgc ctc ctc acc acc atc tac    1440
Tyr Ser Phe Ile Val Phe Ala Val Ile Cys Leu Leu Thr Thr Ile Tyr
    465             470             475

atc ttc ttg att gtc ccg gag acc aag gcc aag acg ttc ata gag atc    1488
Ile Phe Leu Ile Val Pro Glu Thr Lys Ala Lys Thr Phe Ile Glu Ile
480             485             490             495

aac cag att ttc acc aag atg aat aag gtg tct gaa gtg tac ccg gaa    1536
Asn Gln Ile Phe Thr Lys Met Asn Lys Val Ser Glu Val Tyr Pro Glu
            500             505             510

aag gag gaa ctg aaa gag ctt cca cct gtc act tcg gaa cag tga       1581
Lys Glu Glu Leu Lys Glu Leu Pro Pro Val Thr Ser Glu Gln
            515             520             525

ctctggagag gaagccagtg gagctggtct gccagggggct tcccactttg gcttattttt    1641

ctgacttcta gctgtctgtg aatatccaga aataaaacaa ctctgatgtg gaatgcagtc    1701

ctcatctcca gcctccccac cccagtggga actgtgcaaa gggctgcctt gctgttcttg    1761

aagctgggct gtctctctcc atgttggcct gtcaccagac ccgagtcaat taaacagctg    1821

gtcctccact ttgctggttc agccttcgtg tggctcctgg taacgtggct ccaccttgat    1881

gggtcaacct ttgtgtggct cctggtaaca taacaacaac agttactata gtggtgagat    1941

ggaaggaatc aaattttgcc agagaaacta actcggtggc cccaacaggt cttccggggc    2001

catgggcatt tgtttagagc caaattcatc ctcttaccag atccttttcc agaaatacct    2061

gtctaggaag gtgtgatgtc agaaacaatg acatccagaa agctgaggaa caggttcctg    2121

tggagacact gagtcagaat tcttcatcca aattattttg ttagtggaaa atggaattgc    2181

ttctgtgtag tcaataaaat gaacctgatc acttttc                           2218
```

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<210>  41
<211>  15
<212>  PRT
<213>  GLUT5

<400>  41

Leu Leu Ser Pro Phe Ser Ala Arg Val Thr Leu Ala Lys Arg Arg
1           5               10              15


<210>  42
<211>  510
<212>  PRT
<213>  GLUT5

<400>  42

Ala Ala Leu Cys Pro Ser Arg Ala Ser Met Glu Gln Gln Asp Gln Ser
1           5               10              15
```

```
Met Lys Glu Gly Arg Leu Thr Leu Val Leu Ala Leu Ala Thr Leu Ile
        20          25              30

Ala Ala Phe Gly Ser Ser Phe Gln Tyr Gly Tyr Asn Val Ala Ala Val
        35          40              45

Asn Ser Pro Ala Leu Leu Met Gln Gln Phe Tyr Asn Glu Thr Tyr Tyr
    50              55              60

Gly Arg Thr Gly Glu Phe Met Glu Asp Phe Pro Leu Thr Leu Leu Trp
65              70              75              80

Ser Val Thr Val Ser Met Phe Pro Phe Gly Gly Phe Ile Gly Ser Leu
            85              90              95

Leu Val Gly Pro Leu Val Asn Lys Phe Gly Arg Lys Gly Ala Leu Leu
        100             105             110

Phe Asn Asn Ile Phe Ser Ile Val Pro Ala Ile Leu Met Gly Cys Ser
    115             120             125

Arg Val Ala Thr Ser Phe Glu Leu Ile Ile Ile Ser Arg Leu Leu Val
    130             135             140

Gly Ile Cys Ala Gly Val Ser Ser Asn Val Val Pro Met Tyr Leu Gly
145             150             155             160

Glu Leu Ala Pro Lys Asn Leu Arg Gly Ala Leu Gly Val Val Pro Gln
            165             170             175

Leu Phe Ile Thr Val Gly Ile Leu Val Ala Gln Ile Phe Gly Leu Arg
            180             185             190

Asn Leu Leu Ala Asn Val Asp Gly Trp Pro Ile Leu Leu Gly Leu Thr
    195             200             205

Gly Val Pro Ala Ala Leu Gln Leu Leu Leu Leu Pro Phe Phe Pro Glu
    210             215             220

Ser Pro Arg Tyr Leu Leu Ile Gln Lys Lys Asp Glu Ala Ala Ala Lys
225             230             235             240

Lys Ala Leu Gln Thr Leu Arg Gly Trp Asp Ser Val Asp Arg Glu Val
            245             250             255

Ala Glu Ile Arg Gln Glu Asp Glu Ala Glu Lys Ala Ala Gly Phe Ile
            260             265             270
```

80

```
Ser Val Leu Lys Leu Phe Arg Met Arg Ser Leu Arg Trp Gln Leu Leu
        275             280             285

Ser Ile Ile Val Leu Met Gly Gly Gln Gln Leu Ser Gly Val Asn Ala
        290             295             300

Ile Tyr Tyr Tyr Ala Asp Gln Ile Tyr Leu Ser Ala Gly Val Pro Glu
305             310             315             320

Glu His Val Gln Tyr Val Thr Ala Gly Thr Gly Ala Val Asn Val Val
            325             330             335

Met Thr Phe Cys Ala Val Phe Val Val Glu Leu Leu Gly Arg Arg Leu
        340             345             350

Leu Leu Leu Leu Gly Phe Ser Ile Cys Leu Ile Ala Cys Cys Val Leu
        355             360             365

Thr Ala Ala Leu Ala Leu Gln Asp Thr Val Ser Trp Met Pro Tyr Ile
        370             375             380

Ser Ile Val Cys Val Ile Ser Tyr Val Ile Gly His Ala Leu Gly Pro
385             390             395             400

Ser Pro Ile Pro Ala Leu Leu Ile Thr Glu Ile Phe Leu Gln Ser Ser
            405             410             415

Arg Pro Ser Ala Phe Met Val Gly Gly Ser Val His Trp Leu Ser Asn
            420             425             430

Phe Thr Val Gly Leu Ile Phe Pro Phe Ile Gln Glu Gly Leu Gly Pro
        435             440             445

Tyr Ser Phe Ile Val Phe Ala Val Ile Cys Leu Leu Thr Thr Ile Tyr
    450             455             460

Ile Phe Leu Ile Val Pro Glu Thr Lys Ala Lys Thr Phe Ile Glu Ile
465             470             475             480

Asn Gln Ile Phe Thr Lys Met Asn Lys Val Ser Glu Val Tyr Pro Glu
            485             490             495

Lys Glu Glu Leu Lys Glu Leu Pro Pro Val Thr Ser Glu Gln
            500             505             510
```

<210>   43

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<211>  1580
<212>  DNA
<213>  GLUT6

<220>
<221>  CDS
<222>  (47)..(1570)
<223>

<400>  43
tgctccagtc tgagcgccct ccgctcgccc cgagagagac ccggcc atg cag gag      55
                                                    Met Gln Glu
                                                      1

ccg ctg ctg gga gcc gag ggc ccg gac tac gac acc ttc ccc gag aag    103
Pro Leu Leu Gly Ala Glu Gly Pro Asp Tyr Asp Thr Phe Pro Glu Lys
      5               10                  15

ccg ccc ccg tcg cca ggg gac agg gcg cgg gtc ggg acc ctg cag aac    151
Pro Pro Pro Ser Pro Gly Asp Arg Ala Arg Val Gly Thr Leu Gln Asn
 20              25                  30                  35

aaa agg gtg ttc ctg gcc acc ttc gcc gca gtg ctc ggc aat ttc agc    199
Lys Arg Val Phe Leu Ala Thr Phe Ala Ala Val Leu Gly Asn Phe Ser
                40                  45                  50

ttt ggg tat gcc ctg gtc tac aca tcc cct gtc atc cca gcc ctg gag    247
Phe Gly Tyr Ala Leu Val Tyr Thr Ser Pro Val Ile Pro Ala Leu Glu
            55                  60                  65

cgc tcc ttg gat cct gac ctg cat ctg acc aaa tcc cag gca tcc tgg    295
Arg Ser Leu Asp Pro Asp Leu His Leu Thr Lys Ser Gln Ala Ser Trp
            70                  75                  80

ttt ggg tcc gtg ttc acc ctg gga gca gcg gcc gga ggc ctg agt gcc    343
Phe Gly Ser Val Phe Thr Leu Gly Ala Ala Ala Gly Gly Leu Ser Ala
        85                  90                  95

atg atc ctc aac gac ctc ctg ggc cgg aag ctg agc atc atg ttc tca    391
Met Ile Leu Asn Asp Leu Leu Gly Arg Lys Leu Ser Ile Met Phe Ser
100                 105                 110                 115

gct gtg ccg tcg gcg gcc ggc tat gcg ctc atg gcg ggt gcg cac ggc    439
Ala Val Pro Ser Ala Ala Gly Tyr Ala Leu Met Ala Gly Ala His Gly
                120                 125                 130

ctc tgg atg ctg ctg ctc gga agg acg ctg acg ggc ttc gcc ggg ggg    487
Leu Trp Met Leu Leu Leu Gly Arg Thr Leu Thr Gly Phe Ala Gly Gly
            135                 140                 145

ctc aca gct gcc tgc atc ccg gtg tac gtg tct gag att gct ccc cca    535
Leu Thr Ala Ala Cys Ile Pro Val Tyr Val Ser Glu Ile Ala Pro Pro
        150                 155                 160

ggc gtt cgt ggg gct ctg ggg gcc aca ccc cag ctc atg gca gtg ttc    583
Gly Val Arg Gly Ala Leu Gly Ala Thr Pro Gln Leu Met Ala Val Phe
        165                 170                 175

gga tcc ctg tcc ctc tac gcc ctt ggc ctc ctg ctg ccg tgg cgc tgg    631
Gly Ser Leu Ser Leu Tyr Ala Leu Gly Leu Leu Leu Pro Trp Arg Trp
180                 185                 190                 195

ctg gct gtg gcc ggg gag gcg cct gtg ctc atc atg atc ctg ctg ctc    679
```

82

```
Leu Ala Val Ala Gly Glu Ala Pro Val Leu Ile Met Ile Leu Leu Leu
             200             205             210

agc ttc atg ccc aac tcg ccg cgc ttc ctg ctc tct cgg ggc agg gac    727
Ser Phe Met Pro Asn Ser Pro Arg Phe Leu Leu Ser Arg Gly Arg Asp
             215             220             225

gaa gag gcc ctg cgg gcg ctg gcc tgg ctg cgt ggg acg gac gtc gat    775
Glu Glu Ala Leu Arg Ala Leu Ala Trp Leu Arg Gly Thr Asp Val Asp
             230             235             240

gtc cac tgg gag ttc gag cag atc cag gac aac gtc cgg aga cag agc    823
Val His Trp Glu Phe Glu Gln Ile Gln Asp Asn Val Arg Arg Gln Ser
             245             250             255

agc cga gta tcg tgg gct gag gca cgg gcc cca cac gtg tgc cgg ccc    871
Ser Arg Val Ser Trp Ala Glu Ala Arg Ala Pro His Val Cys Arg Pro
260             265             270             275

atc acc gtg gcc ttg ctg atg cgc ctc ctg cag cag ctg acg ggc atc    919
Ile Thr Val Ala Leu Leu Met Arg Leu Leu Gln Gln Leu Thr Gly Ile
             280             285             290

acg ccc atc ctg gtc tac ctg cag tcc atc ttc gac agc acc gct gtc    967
Thr Pro Ile Leu Val Tyr Leu Gln Ser Ile Phe Asp Ser Thr Ala Val
             295             300             305

ctg ctg ccc ccc aag gac gac gca gcc atc gtt ggg gcc gtg cgg ctc   1015
Leu Leu Pro Pro Lys Asp Asp Ala Ala Ile Val Gly Ala Val Arg Leu
             310             315             320

ctg tcc gtg ctg atc gcc gcc ctc acc atg gac ctc gca ggc cgc aag   1063
Leu Ser Val Leu Ile Ala Ala Leu Thr Met Asp Leu Ala Gly Arg Lys
             325             330             335

gtg ctg ctc ttc gtc tca gcg gcc atc atg ttt gct gcc aac ctg act   1111
Val Leu Leu Phe Val Ser Ala Ala Ile Met Phe Ala Ala Asn Leu Thr
340             345             350             355

ctg ggg ctg tac atc cac ttt ggc ccc agg cct ctg agc ccc aac agc   1159
Leu Gly Leu Tyr Ile His Phe Gly Pro Arg Pro Leu Ser Pro Asn Ser
             360             365             370

act gcg ggc ctg gaa agc gag tcc tgg ggg gac ttg gcg cag ccc ctg   1207
Thr Ala Gly Leu Glu Ser Glu Ser Trp Gly Asp Leu Ala Gln Pro Leu
             375             380             385

gca gca ccc gct ggc tac ctc acc ctg gtg ccc ctg ctg gcc acc atg   1255
Ala Ala Pro Ala Gly Tyr Leu Thr Leu Val Pro Leu Leu Ala Thr Met
             390             395             400

ctc ttc atc atg ggc tac gcc gtg ggc tgg ggt ccc atc acc tgg ctg   1303
Leu Phe Ile Met Gly Tyr Ala Val Gly Trp Gly Pro Ile Thr Trp Leu
             405             410             415

ctc atg tct gag gtc ctg ccc ctg cgt gcc cgt ggc gtg gcc tca ggg   1351
Leu Met Ser Glu Val Leu Pro Leu Arg Ala Arg Gly Val Ala Ser Gly
420             425             430             435

ctc tgc gtg ctg gcc agc tgg ctc acc gcc ttc gtc ctc acc aag tcc   1399
Leu Cys Val Leu Ala Ser Trp Leu Thr Ala Phe Val Leu Thr Lys Ser
             440             445             450
```

```
ttc ctg cca gtg gtg agc acc ttc ggc ctc cag gtg cct ttc ttc ttc       1447
Phe Leu Pro Val Val Ser Thr Phe Gly Leu Gln Val Pro Phe Phe Phe
            455                 460                 465

ttc gcg gcc atc tgc ttg gtg agc ctg gtg ttc aca ggc tgc tgt gtg       1495
Phe Ala Ala Ile Cys Leu Val Ser Leu Val Phe Thr Gly Cys Cys Val
            470                 475                 480

ccc gag acc aag gga cgg tcc ctg gag cag atc gag tcc ttc ttc cgc       1543
Pro Glu Thr Lys Gly Arg Ser Leu Glu Gln Ile Glu Ser Phe Phe Arg
        485                 490                 495

atg ggg aga agg tcc ttc ttg cgc tag gtcaaggtcc                        1580
Met Gly Arg Arg Ser Phe Leu Arg
500                 505
```

```
<210>   44
<211>   507
<212>   PRT
<213>   GLUT6

<400>   44

Met Gln Glu Pro Leu Leu Gly Ala Glu Gly Pro Asp Tyr Asp Thr Phe
1               5                   10                  15


Pro Glu Lys Pro Pro Pro Ser Pro Gly Asp Arg Ala Arg Val Gly Thr
            20                  25                  30


Leu Gln Asn Lys Arg Val Phe Leu Ala Thr Phe Ala Ala Val Leu Gly
        35                  40                  45


Asn Phe Ser Phe Gly Tyr Ala Leu Val Tyr Thr Ser Pro Val Ile Pro
        50                  55                  60


Ala Leu Glu Arg Ser Leu Asp Pro Asp Leu His Leu Thr Lys Ser Gln
65                  70                  75                  80


Ala Ser Trp Phe Gly Ser Val Phe Thr Leu Gly Ala Ala Ala Gly Gly
                85                  90                  95


Leu Ser Ala Met Ile Leu Asn Asp Leu Leu Gly Arg Lys Leu Ser Ile
            100                 105                 110


Met Phe Ser Ala Val Pro Ser Ala Ala Gly Tyr Ala Leu Met Ala Gly
        115                 120                 125


Ala His Gly Leu Trp Met Leu Leu Leu Gly Arg Thr Leu Thr Gly Phe
        130                 135                 140


Ala Gly Gly Leu Thr Ala Ala Cys Ile Pro Val Tyr Val Ser Glu Ile
145                 150                 155                 160
```

84

```
Ala Pro Pro Gly Val Arg Gly Ala Leu Gly Ala Thr Pro Gln Leu Met
             165                 170                 175

Ala Val Phe Gly Ser Leu Ser Leu Tyr Ala Leu Gly Leu Leu Leu Pro
             180                 185                 190

Trp Arg Trp Leu Ala Val Ala Gly Glu Ala Pro Val Leu Ile Met Ile
         195                 200                 205

Leu Leu Leu Ser Phe Met Pro Asn Ser Pro Arg Phe Leu Leu Ser Arg
    210             .   215                 220

Gly Arg Asp Glu Glu Ala Leu Arg Ala Leu Ala Trp Leu Arg Gly Thr
225                 230                 235                 240
                .

Asp Val Asp Val His Trp Glu Phe Glu Gln Ile Gln Asp Asn Val Arg
             245                 250                 255

Arg Gln Ser Ser Arg Val Ser Trp Ala Glu Ala Arg Ala Pro His Val
         260                 265                 270

Cys Arg Pro Ile Thr Val Ala Leu Leu Met Arg Leu Leu Gln Gln Leu
         275                 280                 285

Thr Gly Ile Thr Pro Ile Leu Val Tyr Leu Gln Ser Ile Phe Asp Ser
    290                 295                 300

Thr Ala Val Leu Leu Pro Pro Lys Asp Asp Ala Ala Ile Val Gly Ala
305                 310                 315                 320

Val Arg Leu Leu Ser Val Leu Ile Ala Ala Leu Thr Met Asp Leu Ala
             325                 330                 335

Gly Arg Lys Val Leu Leu Phe Val Ser Ala Ala Ile Met Phe Ala Ala
         340     .           345                 350

Asn Leu Thr Leu Gly Leu Tyr Ile His Phe Gly Pro Arg Pro Leu Ser
         355                 360                 365

Pro Asn Ser Thr Ala Gly Leu Glu Ser Glu Ser Trp Gly Asp Leu Ala
    370                 375                 380

Gln Pro Leu Ala Ala Pro Ala Gly Tyr Leu Thr Leu Val Pro Leu Leu
385                 390                 395                 400

Ala Thr Met Leu Phe Ile Met Gly Tyr Ala Val Gly Trp Gly Pro Ile
             405                 410                 415
```

85

```
Thr Trp Leu Leu Met Ser Glu Val Leu Pro Leu Arg Ala Arg Gly Val
        420                 425             430

Ala Ser Gly Leu Cys Val Leu Ala Ser Trp Leu Thr Ala Phe Val Leu
        435                 440             445

Thr Lys Ser Phe Leu Pro Val Val Ser Thr Phe Gly Leu Gln Val Pro
    450                 455             460

Phe Phe Phe Phe Ala Ala Ile Cys Leu Val Ser Leu Val Phe Thr Gly
465                 470             475                 480

Cys Cys Val Pro Glu Thr Lys Gly Arg Ser Leu Glu Gln Ile Glu Ser
                485             490                 495

Phe Phe Arg Met Gly Arg Arg Ser Phe Leu Arg
        500                 505
```

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<210>   45
<211>   1575
<212>   DNA
<213>   GLUT7

<220>
<221>   CDS
<222>   (1)..(1575)
<223>

<400>   45
atg gag aac aaa gag gcg gga acc cct cca ccc att cca tcc agg gag      48
Met Glu Asn Lys Glu Ala Gly Thr Pro Pro Pro Ile Pro Ser Arg Glu
1               5                   10                  15

ggg cgg ctc cag ccg acg ctg ttg ctg gcg aca ctg agc gcg gcc ttt      96
Gly Arg Leu Gln Pro Thr Leu Leu Leu Ala Thr Leu Ser Ala Ala Phe
            20                  25                  30

ggc tca gcc ttc cag tac ggc tac aac ctc tct gtg gtc aac acg ccg     144
Gly Ser Ala Phe Gln Tyr Gly Tyr Asn Leu Ser Val Val Asn Thr Pro
        35              40                  45

cac aag gtg ggc aca agc tgt gga tgg ggc aat gtt ttc cag gtc ttc     192
His Lys Val Gly Thr Ser Cys Gly Trp Gly Asn Val Phe Gln Val Phe
    50              55                  60

aag tca ttt tac aac gaa acc tac ttt gag cga cac gca aca ttc atg     240
Lys Ser Phe Tyr Asn Glu Thr Tyr Phe Glu Arg His Ala Thr Phe Met
65              70                  75                  80

gac ggg aag ctc atg ctg ctt cta tgg tct tgc acc gtc tcc atg ttt     288
Asp Gly Lys Leu Met Leu Leu Leu Trp Ser Cys Thr Val Ser Met Phe
            85                  90                  95

cct ctg ggc ggc ctg ttg ggg tca ttg ctc gtg ggc ctg ctg gtt gat     336
Pro Leu Gly Gly Leu Leu Gly Ser Leu Leu Val Gly Leu Leu Val Asp
```

86

```
                    100                   105                   110

agc tgc ggc aga aag ggg acc ctg ctg atc aac aac atc ttt gcc atc        384
Ser Cys Gly Arg Lys Gly Thr Leu Leu Ile Asn Asn Ile Phe Ala Ile
        115                   120                   125

atc ccc gcc atc ctg atg gga gtc agc aaa gtg gcc aag gct ttt gag        432
Ile Pro Ala Ile Leu Met Gly Val Ser Lys Val Ala Lys Ala Phe Glu
    130                   135                   140

ctg atc gtc ttt tcc cga gtg gtg ctg gga gtc tgt gca ggc atc tcc        480
Leu Ile Val Phe Ser Arg Val Val Leu Gly Val Cys Ala Gly Ile Ser
145                   150                   155                   160

tac agc gcc ctt ccc atg tac ctg gga gaa ctg gcc ccc aag aac ctg        528
Tyr Ser Ala Leu Pro Met Tyr Leu Gly Glu Leu Ala Pro Lys Asn Leu
                  165                   170                   175

aga ggc atg gtg gga aca atg acc gag gtt ttc gtc atc gtt gga gtc        576
Arg Gly Met Val Gly Thr Met Thr Glu Val Phe Val Ile Val Gly Val
                  180                   185                   190

ttc cta gca cag atc ttc agc ctc cag gcc atc ttg ggc aac ccg gca        624
Phe Leu Ala Gln Ile Phe Ser Leu Gln Ala Ile Leu Gly Asn Pro Ala
                  195                   200                   205

ggc tgg ccg gtg ctt ctg gcg ctc aca ggg gtg ccc gcc ctg ctg cag        672
Gly Trp Pro Val Leu Leu Ala Leu Thr Gly Val Pro Ala Leu Leu Gln
        210                   215                   220

ctg ctg acc ctg ccc ttc ttc ccc gaa agc ccc cgc tac tcc ctg att        720
Leu Leu Thr Leu Pro Phe Phe Pro Glu Ser Pro Arg Tyr Ser Leu Ile
225                   230                   235                   240

cag aaa gga gat gaa gcc aca gcg cga caa gct ctg agg agg ctg aga        768
Gln Lys Gly Asp Glu Ala Thr Ala Arg Gln Ala Leu Arg Arg Leu Arg
                  245                   250                   255

ggc cac acg gac atg gag gcc gag ctg gag gac atg cgt gcg gag gcc        816
Gly His Thr Asp Met Glu Ala Glu Leu Glu Asp Met Arg Ala Glu Ala
                  260                   265                   270

cgg gcc gag cgc gcc gag ggc cac ctg tct gtg ctg cac ctc tgt gcc        864
Arg Ala Glu Arg Ala Glu Gly His Leu Ser Val Leu His Leu Cys Ala
        275                   280                   285

ctg cgg tcc ctg cgc tgg cag ctc ctc tcc atc atc gtg ctc atg gcc        912
Leu Arg Ser Leu Arg Trp Gln Leu Leu Ser Ile Ile Val Leu Met Ala
        290                   295                   300

ggc cag cag ctg tcg ggc atc aat gcg atc aac tac tat gcg gac acc        960
Gly Gln Gln Leu Ser Gly Ile Asn Ala Ile Asn Tyr Tyr Ala Asp Thr
305                   310                   315                   320

atc tac aca tct gcg ggc gtg gag gcc gct cac tcc caa tat gta acg       1008
Ile Tyr Thr Ser Ala Gly Val Glu Ala Ala His Ser Gln Tyr Val Thr
                  325                   330                   335

gtg ggc tct ggc gtc gtc aac ata gtg atg acc atc acc tcg gct gtc       1056
Val Gly Ser Gly Val Val Asn Ile Val Met Thr Ile Thr Ser Ala Val
                  340                   345                   350

ctt gtg gag cgg ctg gga cgg cgg cac ctc ctg ctg gcc ggc tac ggc       1104
```

```
                Leu Val Glu Arg Leu Gly Arg Arg His Leu Leu Leu Ala Gly Tyr Gly
                        355             360             365

atc tgc ggc tct gcc tgc ctg gtg ctg acg gtg gtg ctc cta ttc cag            1152
Ile Cys Gly Ser Ala Cys Leu Val Leu Thr Val Val Leu Leu Phe Gln
        370             375             380

aac agg gtc ccc gag ctg tcc tac ctc ggc atc atc tgt gtc ttt gcc           1200
Asn Arg Val Pro Glu Leu Ser Tyr Leu Gly Ile Ile Cys Val Phe Ala
385             390             395             400

tac atc gcg gga cat tcc att ggg ccc agt cct gtc ccc tcg gtg gtg          1248
Tyr Ile Ala Gly His Ser Ile Gly Pro Ser Pro Val Pro Ser Val Val
                405             410             415

agg acc gag atc ttc ctg cag tcc tcc cgg cgg gca gct ttc atg gtg          1296
Arg Thr Glu Ile Phe Leu Gln Ser Ser Arg Arg Ala Ala Phe Met Val
                420             425             430

gac ggg gca gtg cac tgg ctc acc aac ttc atc ata ggc ttc ctg ttc          1344
Asp Gly Ala Val His Trp Leu Thr Asn Phe Ile Ile Gly Phe Leu Phe
                435             440             445

cca tcc atc cag gag gcc atc ggt gcc tac agt ttc atc atc ttt gcc          1392
Pro Ser Ile Gln Glu Ala Ile Gly Ala Tyr Ser Phe Ile Ile Phe Ala
        450             455             460

gga atc tgc ctc ctc act gcg att tac atc tac gtg gtt att ccg gag          1440
Gly Ile Cys Leu Leu Thr Ala Ile Tyr Ile Tyr Val Val Ile Pro Glu
465             470             475             480

acc aag ggc aaa aca ttt gtg gag ata aac cgc att ttt gcc aag aga          1488
Thr Lys Gly Lys Thr Phe Val Glu Ile Asn Arg Ile Phe Ala Lys Arg
                485             490             495

aac agg gtg aag ctt cca gag gag aaa gaa gaa acc att gat gct ggg          1536
Asn Arg Val Lys Leu Pro Glu Glu Lys Glu Glu Thr Ile Asp Ala Gly
                500             505             510

cct ccc aca gcc tct cct gcc aag gaa act tcc ttt tag                       1575
Pro Pro Thr Ala Ser Pro Ala Lys Glu Thr Ser Phe
                515             520
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<210> 46
<211> 524
<212> PRT
<213> GLUT7

<400> 46

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Met Glu Asn Lys Glu Ala Gly Thr Pro Pro Pro Ile Pro Ser Arg Glu
1               5               10              15

Gly Arg Leu Gln Pro Thr Leu Leu Leu Ala Thr Leu Ser Ala Ala Phe
        20              25              30

Gly Ser Ala Phe Gln Tyr Gly Tyr Asn Leu Ser Val Val Asn Thr Pro
        35              40              45
```

His Lys Val Gly Thr Ser Cys Gly Trp Gly Asn Val Phe Gln Val Phe
    50   55   60

Lys Ser Phe Tyr Asn Glu Thr Tyr Phe Glu Arg His Ala Thr Phe Met
65   70   75   80

Asp Gly Lys Leu Met Leu Leu Leu Trp Ser Cys Thr Val Ser Met Phe
          85   90   95

Pro Leu Gly Gly Leu Leu Gly Ser Leu Leu Val Gly Leu Leu Val Asp
        100   105   110

Ser Cys Gly Arg Lys Gly Thr Leu Leu Ile Asn Asn Ile Phe Ala Ile
        115   120   125

Ile Pro Ala Ile Leu Met Gly Val Ser Lys Val Ala Lys Ala Phe Glu
    130   135   140

Leu Ile Val Phe Ser Arg Val Val Leu Gly Val Cys Ala Gly Ile Ser
145   150   155   160

Tyr Ser Ala Leu Pro Met Tyr Leu Gly Glu Leu Ala Pro Lys Asn Leu
        165   170   175

Arg Gly Met Val Gly Thr Met Thr Glu Val Phe Val Ile Val Gly Val
        180   185   190

Phe Leu Ala Gln Ile Phe Ser Leu Gln Ala Ile Leu Gly Asn Pro Ala
        195   200   205

Gly Trp Pro Val Leu Leu Ala Leu Thr Gly Val Pro Ala Leu Leu Gln
    210   215   220

Leu Leu Thr Leu Pro Phe Phe Pro Glu Ser Pro Arg Tyr Ser Leu Ile
225   230   235   240

Gln Lys Gly Asp Glu Ala Thr Ala Arg Gln Ala Leu Arg Arg Leu Arg
        245   250   255

Gly His Thr Asp Met Glu Ala Glu Leu Glu Asp Met Arg Ala Glu Ala
        260   265   270

Arg Ala Glu Arg Ala Glu Gly His Leu Ser Val Leu His Leu Cys Ala
        275   280   285

Leu Arg Ser Leu Arg Trp Gln Leu Leu Ser Ile Ile Val Leu Met Ala
    290   295   300

```
Gly Gln Gln Leu Ser Gly Ile Asn Ala Ile Asn Tyr Tyr Ala Asp Thr
305             310         315             320


Ile Tyr Thr Ser Ala Gly Val Glu Ala Ala His Ser Gln Tyr Val Thr
            325             330             335


Val Gly Ser Gly Val Val Asn Ile Val Met Thr Ile Thr Ser Ala Val
            340             345             350


Leu Val Glu Arg Leu Gly Arg Arg His Leu Leu Leu Ala Gly Tyr Gly
    355             360             365


Ile Cys Gly Ser Ala Cys Leu Val Leu Thr Val Val Leu Leu Phe Gln
    370             375             380


Asn Arg Val Pro Glu Leu Ser Tyr Leu Gly Ile Ile Cys Val Phe Ala
385             390             395             400


Tyr Ile Ala Gly His Ser Ile Gly Pro Ser Pro Val Pro Ser Val Val
            405             410             415


Arg Thr Glu Ile Phe Leu Gln Ser Ser Arg Arg Ala Ala Phe Met Val
            420             425             430


Asp Gly Ala Val His Trp Leu Thr Asn Phe Ile Ile Gly Phe Leu Phe
            435             440             445


Pro Ser Ile Gln Glu Ala Ile Gly Ala Tyr Ser Phe Ile Ile Phe Ala
    450             455             460


Gly Ile Cys Leu Leu Thr Ala Ile Tyr Ile Tyr Val Val Ile Pro Glu
465             470             475             480


Thr Lys Gly Lys Thr Phe Val Glu Ile Asn Arg Ile Phe Ala Lys Arg
            485             490             495


Asn Arg Val Lys Leu Pro Glu Glu Lys Glu Glu Thr Ile Asp Ala Gly
            500             505             510


Pro Pro Thr Ala Ser Pro Ala Lys Glu Thr Ser Phe
        515             520
```

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<210>   47
<211>   1508
<212>   DNA
<213>   GLUT8

<220>
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90

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<221>    CDS
<222>    (27)..(1460)
<223>

<400>    47
agctggccga tgcgttggcc gccgac atg acg ccc gag gac cca gag gaa acc        53
                              Met Thr Pro Glu Asp Pro Glu Glu Thr
                              1               5

cag ccg ctt ctg ggg cct cct ggc ggc agc gcg ccc cgc ggc cgc cgc       101
Gln Pro Leu Leu Gly Pro Pro Gly Gly Ser Ala Pro Arg Gly Arg Arg
10              15              20                  25

gtc ttc ctc gcc gcc ttc gcc gct gcc ctg ggc cca ctc agc ttc ggc       149
Val Phe Leu Ala Ala Phe Ala Ala Ala Leu Gly Pro Leu Ser Phe Gly
            30              35              40

ttc gcg ctc ggc tac agc tcc ccg gcc atc cct agc ctg cag cgc gcc       197
Phe Ala Leu Gly Tyr Ser Ser Pro Ala Ile Pro Ser Leu Gln Arg Ala
            45              50              55

gcg ccc ccg gcc ccg cgc ctg gac gac gcc gcc gcc tcc tgg ttc ggg       245
Ala Pro Pro Ala Pro Arg Leu Asp Asp Ala Ala Ala Ser Trp Phe Gly
        60              65              70

gct gtc gtg acc ctg ggt gcc gcg gcg ggg gga gtg ctg ggc ggc tgg       293
Ala Val Val Thr Leu Gly Ala Ala Ala Gly Gly Val Leu Gly Gly Trp
        75              80              85

ctg gtg gac cgc gcc ggg cgc aag ctg agc ctc ttg ctg tgc tcc gtg       341
Leu Val Asp Arg Ala Gly Arg Lys Leu Ser Leu Leu Leu Cys Ser Val
90              95              100             105

ccc ttc gtg gcc ggc ttt gcc gtc atc acc gcg gcc cag gac gtg tgg       389
Pro Phe Val Ala Gly Phe Ala Val Ile Thr Ala Ala Gln Asp Val Trp
            110             115             120

atg ctg ctg ggg ggc cgc ctc ctc acc ggc ctg gcc tgc ggt gtt gcc       437
Met Leu Leu Gly Gly Arg Leu Leu Thr Gly Leu Ala Cys Gly Val Ala
            125             130             135

tcc cta gtg gcc ccg gtc tac atc tcc gaa atc gcc tac cca gca gtc       485
Ser Leu Val Ala Pro Val Tyr Ile Ser Glu Ile Ala Tyr Pro Ala Val
            140             145             150

cgg ggg ttg ctc ggc tcc tgt gtg cag cta atg gtc gtc gtc ggc atc       533
Arg Gly Leu Leu Gly Ser Cys Val Gln Leu Met Val Val Val Gly Ile
155             160             165

ctc ctg gcc tac ctg gca ggc tgg gtg ctg gag tgg cgc tgg ctg gct       581
Leu Leu Ala Tyr Leu Ala Gly Trp Val Leu Glu Trp Arg Trp Leu Ala
170             175             180             185

gtg ctg ggc tgc gtg ccc ccc tcc ctc atg ctg ctt ctc atg tgc ttc       629
Val Leu Gly Cys Val Pro Pro Ser Leu Met Leu Leu Met Cys Phe
            190             195             200

atg ccc gag acc ccg cgc ttc ctg ctg act cag cac agg cgc cag gag       677
Met Pro Glu Thr Pro Arg Phe Leu Leu Thr Gln His Arg Arg Gln Glu
            205             210             215

gcc atg gcc gcc ctg cgg ttc ctg tgg ggc tcc gag cag ggc tgg gaa       725
Ala Met Ala Ala Leu Arg Phe Leu Trp Gly Ser Glu Gln Gly Trp Glu
```

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              220                225                230

gac ccc ccc atc ggg gct gag cag agc ttt cac ctg gcc ctg ctg cgg      773
Asp Pro Pro Ile Gly Ala Glu Gln Ser Phe His Leu Ala Leu Leu Arg
    235                240                245

cag ccc ggc atc tac aag ccc ttc atc atc ggc gtc tcc ctg atg gcc      821
Gln Pro Gly Ile Tyr Lys Pro Phe Ile Ile Gly Val Ser Leu Met Ala
250                255                260                265

ttc cag cag ctg tcg ggg gtc aac gcc gtc atg ttc tat gca gag acc      869
Phe Gln Gln Leu Ser Gly Val Asn Ala Val Met Phe Tyr Ala Glu Thr
                270                275                280

atc ttt gaa gag gcc aag ttc aag gac agc agc ctg gcc tcg gtc gtc      917
Ile Phe Glu Glu Ala Lys Phe Lys Asp Ser Ser Leu Ala Ser Val Val
                285                290                295

gtg ggt gtc atc cag gtg ctg ttc aca gct gtg gcg gct ctc atc atg      965
Val Gly Val Ile Gln Val Leu Phe Thr Ala Val Ala Ala Leu Ile Met
                300                305                310

gac aga gca ggg cgg agg ctg ctc ctg gtc ttg tca ggt gtg gtc atg     1013
Asp Arg Ala Gly Arg Arg Leu Leu Leu Val Leu Ser Gly Val Val Met
                315                320                325

gtg ttc agc acg agt gcc ttc ggc gcc tac ttc aag ctg acc cag ggt     1061
Val Phe Ser Thr Ser Ala Phe Gly Ala Tyr Phe Lys Leu Thr Gln Gly
330                335                340                345

ggc cct ggc aac tcc tcg cac gtg gcc atc tcg gcg cct gtc tct gca     1109
Gly Pro Gly Asn Ser Ser His Val Ala Ile Ser Ala Pro Val Ser Ala
                350                355                360

cag cct gtt gat gcc agc gtg ggg ctg gcc tgg ctg gcc gtg ggc agc     1157
Gln Pro Val Asp Ala Ser Val Gly Leu Ala Trp Leu Ala Val Gly Ser
                365                370                375

atg tgc ctc ttc atc gcc ggc ttt gcg gtg ggc tgg ggg ccc atc ccc     1205
Met Cys Leu Phe Ile Ala Gly Phe Ala Val Gly Trp Gly Pro Ile Pro
                380                385                390

tgg ctc ctc atg tca gag atc ttc cct ctg cat gtc aag ggc gtg gcg     1253
Trp Leu Leu Met Ser Glu Ile Phe Pro Leu His Val Lys Gly Val Ala
                395                400                405

aca ggc atc tgc gtc ctc acc aac tgg ctc atg gcc ttt ctc gtg acc     1301
Thr Gly Ile Cys Val Leu Thr Asn Trp Leu Met Ala Phe Leu Val Thr
410                415                420                425

aag gag ttc agc agc ctc atg gag gtc ctc agg ccc tat gga gcc ttc     1349
Lys Glu Phe Ser Ser Leu Met Glu Val Leu Arg Pro Tyr Gly Ala Phe
                430                435                440

tgg ctt gcc tcc gct ttc tgc atc ttc agt gtc ctt ttc act ttt tcc     1397
Trp Leu Ala Ser Ala Phe Cys Ile Phe Ser Val Leu Phe Thr Phe Ser
                445                450                455

tgt gtc cct gaa act aaa gga aag act ctg gaa caa atc aca gcc cat     1445
Cys Val Pro Glu Thr Lys Gly Lys Thr Leu Glu Gln Ile Thr Ala His
                460                465                470

ttt gag ggg cga tga cagccactca ctaggggatg gagcaagcct gtgactccaa     1500
Phe Glu Gly Arg
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92

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Phe Glu Gly Arg
    475

gctgggcc                        .                                              1508


<210>   48
<211>   477
<212>   PRT
<213>   GLUT8

<400>   48

Met Thr Pro Glu Asp Pro Glu Glu Thr Gln Pro Leu Leu Gly Pro Pro
1               5                   10                  15


Gly Gly Ser Ala Pro Arg Gly Arg Arg Val Phe Leu Ala Ala Phe Ala
            20              25                  30


Ala Ala Leu Gly Pro Leu Ser Phe Gly Phe Ala Leu Gly Tyr Ser Ser
        35              40                  45


Pro Ala Ile Pro Ser Leu Gln Arg Ala Ala Pro Pro Ala Pro Arg Leu
    50              55                  60


Asp Asp Ala Ala Ala Ser Trp Phe Gly Ala Val Val Thr Leu Gly Ala
65                  70                  75                  80


Ala Ala Gly Gly Val Leu Gly Gly Trp Leu Val Asp Arg Ala Gly Arg
                85                  90                  95


Lys Leu Ser Leu Leu Leu Cys Ser Val Pro Phe Val Ala Gly Phe Ala
            100                 105                 110


Val Ile Thr Ala Ala Gln Asp Val Trp Met Leu Leu Gly Gly Arg Leu
            115                 120                 125


Leu Thr Gly Leu Ala Cys Gly Val Ala Ser Leu Val Ala Pro Val Tyr
    130                 135                 140


Ile Ser Glu Ile Ala Tyr Pro Ala Val Arg Gly Leu Leu Gly Ser Cys
145                 150                 155                 160


Val Gln Leu Met Val Val Val Gly Ile Leu Leu Ala Tyr Leu Ala Gly
                165                 170                 175


Trp Val Leu Glu Trp Arg Trp Leu Ala Val Leu Gly Cys Val Pro Pro
                180                 185                 190         .


Ser Leu Met Leu Leu Leu Met Cys Phe Met Pro Glu Thr Pro Arg Phe
            195                 200                 205
```

Leu Leu Thr Gln His Arg Arg Gln Glu Ala Met Ala Ala Leu Arg Phe
    210   215   220

Leu Trp Gly Ser Glu Gln Gly Trp Glu Asp Pro Pro Ile Gly Ala Glu
225   230   235   240

Gln Ser Phe His Leu Ala Leu Leu Arg Gln Pro Gly Ile Tyr Lys Pro
            245   250   255

Phe Ile Ile Gly Val Ser Leu Met Ala Phe Gln Gln Leu Ser Gly Val
            260   265   270

Asn Ala Val Met Phe Tyr Ala Glu Thr Ile Phe Glu Glu Ala Lys Phe
        275   280   285   .

Lys Asp Ser Ser Leu Ala Ser Val Val Val Gly Val Ile Gln Val Leu
    290   295   300

Phe Thr Ala Val Ala Ala Leu Ile Met Asp Arg Ala Gly Arg Arg Leu
305   310   315   320

Leu Leu Val Leu Ser Gly Val Val Met Val Phe Ser Thr Ser Ala Phe
            325   .   330   335

Gly Ala Tyr Phe Lys Leu Thr Gln Gly Gly Pro Gly Asn Ser Ser His
            340   345   350

Val Ala Ile Ser Ala Pro Val Ser Ala Gln Pro Val Asp Ala Ser Val
            355   360   365

Gly Leu Ala Trp Leu Ala Val Gly Ser Met Cys Leu Phe Ile Ala Gly
    370   375   380

Phe Ala Val Gly Trp Gly Pro Ile Pro Trp Leu Leu Met Ser Glu Ile
385   390   395   400

Phe Pro Leu His Val Lys Gly Val Ala Thr Gly Ile Cys Val Leu Thr
            405   410   415

Asn Trp Leu Met Ala Phe Leu Val Thr Lys Glu Phe Ser Ser Leu Met
        420   425   430

Glu Val Leu Arg Pro Tyr Gly Ala Phe Trp Leu Ala Ser Ala Phe Cys
    435   440   445

Ile Phe Ser Val Leu Phe Thr Phe Ser Cys Val Pro Glu Thr Lys Gly

94

```
         450              455              460


Lys Thr Leu Glu Gln Ile Thr Ala His Phe Glu Gly Arg
465                  470              475


<210>  49
<211>  1863
<212>  DNA
<213>  GLUT9

<220>
<221>  CDS
<222>  (55)..(1677)
<223>

<400>  49
cttggcagag tctggggtcc ctggactgag ccatcagctg ggtcactgag accc atg        57
                                                               Met
                                                               1

gca agg aaa caa aat agg aat tcc aag gaa ctg ggc cta gtt ccc ctc       105
Ala Arg Lys Gln Asn Arg Asn Ser Lys Glu Leu Gly Leu Val Pro Leu
              5                  10                  15

aca gat gac acc agc cac gcc agg cct cca ggg cca ggg agg gca ctg       153
Thr Asp Asp Thr Ser His Ala Arg Pro Pro Gly Pro Gly Arg Ala Leu
          20                  25                  30

ctg gag tgt gac cac ctg agg agt ggg gtg cca ggt gga agg aga aga       201
Leu Glu Cys Asp His Leu Arg Ser Gly Val Pro Gly Gly Arg Arg Arg
      35                  40                  45

aag gac tgg tcc tgc tcg ctc ctc gtg gcc tcc ctc gcg ggc gcc ttc       249
Lys Asp Trp Ser Cys Ser Leu Leu Val Ala Ser Leu Ala Gly Ala Phe
50                  55                  60                  65

ggc tcc tcc ttc ctc tac ggc tac aac ctg tcg gtg gtg aat gcc ccc       297
Gly Ser Ser Phe Leu Tyr Gly Tyr Asn Leu Ser Val Val Asn Ala Pro
                  70                  75                  80

acc ccg tac atc aag gcc ttt tac aat gag tca tgg gaa aga agg cat       345
Thr Pro Tyr Ile Lys Ala Phe Tyr Asn Glu Ser Trp Glu Arg Arg His
                  85                  90                  95

gga cgt cca ata gac cca gac act ctg act ctg ctc tgg tct gtg act       393
Gly Arg Pro Ile Asp Pro Asp Thr Leu Thr Leu Leu Trp Ser Val Thr
              100                 105                 110

gtg tcc ata ttc gcc atc ggt gga ctt gtg ggg aca tta att gtg aag       441
Val Ser Ile Phe Ala Ile Gly Gly Leu Val Gly Thr Leu Ile Val Lys
          115                 120                 125

atg att gga aag gtt ctt ggg agg aag cac act ttg ctg gcc aat aat       489
Met Ile Gly Lys Val Leu Gly Arg Lys His Thr Leu Leu Ala Asn Asn
130                 135                 140                 145

ggg ttt gca att tct gct gca ttg ctg atg gcc tgc tcg ctc cag gca       537
Gly Phe Ala Ile Ser Ala Ala Leu Leu Met Ala Cys Ser Leu Gln Ala
                  150                 155                 160

gga gcc ttt gaa atg ctc atc gtg gga cgc ttc atc atg ggc ata gat       585
```

95

```
            Gly Ala Phe Glu Met Leu Ile Val Gly Arg Phe Ile Met Gly Ile Asp
                        165             170             175

gga ggc gtc gcc ctc agt gtg ctc ccc atg tac ctc agt gag atc tca        633
Gly Gly Val Ala Leu Ser Val Leu Pro Met Tyr Leu Ser Glu Ile Ser
            180             185             190

ccc aag gag atc cgt ggc tct ctg ggg cag gtg act gcc atc ttt atc        681
Pro Lys Glu Ile Arg Gly Ser Leu Gly Gln Val Thr Ala Ile Phe Ile
        195             200             205

tgc att ggc gtg ttc act ggg cag ctt ctg ggc ctg ccc gag ctg ctg        729
Cys Ile Gly Val Phe Thr Gly Gln Leu Leu Gly Leu Pro Glu Leu Leu
210             215             220             225

gga aag gag agt acc tgg cca tac ctg ttt gga gtg att gtg gtc cct        777
Gly Lys Glu Ser Thr Trp Pro Tyr Leu Phe Gly Val Ile Val Val Pro
                230             235             240

gcc gtt gtc cag ctg ctg agc ctt ccc ttt ctc ccg gac agc cca cgc        825
Ala Val Val Gln Leu Leu Ser Leu Pro Phe Leu Pro Asp Ser Pro Arg
            245             250             255

tac ctg ctc ttg gag aag cac aac gag gca aga gct gtg aaa gcc ttc        873
Tyr Leu Leu Leu Glu Lys His Asn Glu Ala Arg Ala Val Lys Ala Phe
            260             265             270

caa acg ttc ttg ggt aaa gca gac gtt tcc caa gag gta gag gag gtc        921
Gln Thr Phe Leu Gly Lys Ala Asp Val Ser Gln Glu Val Glu Glu Val
        275             280             285

ctg gct gag agc cgc gtg cag agg agc atc cgc ctg gtg tcc gtg ctg        969
Leu Ala Glu Ser Arg Val Gln Arg Ser Ile Arg Leu Val Ser Val Leu
290             295             300             305

gag ctg ctg aga gct ccc tac gtc cgc tgg cag gtg gtc acc gtg att       1017
Glu Leu Leu Arg Ala Pro Tyr Val Arg Trp Gln Val Val Thr Val Ile
                310             315             320

gtc acc atg gcc tgc tac cag ctc tgt ggc ctc aat gca att tgg ttc       1065
Val Thr Met Ala Cys Tyr Gln Leu Cys Gly Leu Asn Ala Ile Trp Phe
            325             330             335

tat acc aac agc atc ttt gga aaa gct ggg atc cct ctg gca aag atc       1113
Tyr Thr Asn Ser Ile Phe Gly Lys Ala Gly Ile Pro Leu Ala Lys Ile
            340             345             350

cca tac gtc acc ttg agt aca ggg ggc atc gag act ttg gct gcc gtc       1161
Pro Tyr Val Thr Leu Ser Thr Gly Gly Ile Glu Thr Leu Ala Ala Val
        355             360             365

ttc tct ggt ttg gtc att gag cac ctg gga cgg aga ccc ctc ctc att       1209
Phe Ser Gly Leu Val Ile Glu His Leu Gly Arg Arg Pro Leu Leu Ile
370             375             380             385

ggt ggc ttt ggg ctc atg ggc ctc ttc ttt ggg acc ctc acc atc acg       1257
Gly Gly Phe Gly Leu Met Gly Leu Phe Phe Gly Thr Leu Thr Ile Thr
            390             395             400

ctg acc ctg cag gac cac gcc ccc tgg gtc ccc tac ctg agt atc gtg       1305
Leu Thr Leu Gln Asp His Ala Pro Trp Val Pro Tyr Leu Ser Ile Val
            405             410             415
```

```
ggc att ctg gcc atc atc gcc tct ttc tgc agt ggg cca ggt ggc atc      1353
Gly Ile Leu Ala Ile Ile Ala Ser Phe Cys Ser Gly Pro Gly Gly Ile
        420             425             430

ccg ttc atc ttg act ggt gag ttc ttc cag caa tct cag cgg ccg gct      1401
Pro Phe Ile Leu Thr Gly Glu Phe Phe Gln Gln Ser Gln Arg Pro Ala
        435             440             445

gcc ttc atc att gca ggc acc gtc aac tgg ctc tcc aac ttt gct gtt      1449
Ala Phe Ile Ile Ala Gly Thr Val Asn Trp Leu Ser Asn Phe Ala Val
450             455             460             465

ggg ctc ctc ttc cca ttc att cag aaa agt ctg gac acc tac tgt ttc      1497
Gly Leu Leu Phe Pro Phe Ile Gln Lys Ser Leu Asp Thr Tyr Cys Phe
            470             475             480

cta gtc ttt gct aca att tgt atc aca ggt gct atc tac ctg tat ttt      1545
Leu Val Phe Ala Thr Ile Cys Ile Thr Gly Ala Ile Tyr Leu Tyr Phe
            485             490             495

gtg ctg cct gag acc aaa aac aga acc tat gca gaa atc agc cag gca      1593
Val Leu Pro Glu Thr Lys Asn Arg Thr Tyr Ala Glu Ile Ser Gln Ala
        500             505             510

ttt tcc aaa agg aac aaa gca tac cca cca gaa gag aaa atc gac tca      1641
Phe Ser Lys Arg Asn Lys Ala Tyr Pro Pro Glu Glu Lys Ile Asp Ser
        515             520             525

gct gtc act gat ggt aag ata aat gga agg cct taa caagtttcct           1687
Ala Val Thr Asp Gly Lys Ile Asn Gly Arg Pro
530             535             540

cctccacgtt ggacaattat gtcaaaaaca ggattgtcta catggatgat ctcacttttc    1747

aggaaactta aaatttaccc attattggga agcttaaatg aattgaagct atgcaagtct    1807

tttatattat taaatatttа aaagtaaacc tgtactaatc taaaaaaaaa aaaaaa        1863
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<213>  GLUT9

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Met Ala Arg Lys Gln Asn Arg Asn Ser Lys Glu Leu Gly Leu Val Pro
1               5               10              15


Leu Thr Asp Asp Thr Ser His Ala Arg Pro Pro Gly Pro Gly Arg Ala
            20              25              30


Leu Leu Glu Cys Asp His Leu Arg Ser Gly Val Pro Gly Gly Arg Arg
        35              40              45


Arg Lys Asp Trp Ser Cys Ser Leu Leu Val Ala Ser Leu Ala Gly Ala
    50              55              60


Phe Gly Ser Ser Phe Leu Tyr Gly Tyr Asn Leu Ser Val Val Asn Ala
```

```
65                      70                      75                      80


Pro Thr Pro Tyr Ile Lys Ala Phe Tyr Asn Glu Ser Trp Glu Arg Arg
            85              90              95


His Gly Arg Pro Ile Asp Pro Asp Thr Leu Thr Leu Leu Trp Ser Val
            100             105             110


Thr Val Ser Ile Phe Ala Ile Gly Gly Leu Val Gly Thr Leu Ile Val
            115             120             125


Lys Met Ile Gly Lys Val Leu Gly Arg Lys His Thr Leu Leu Ala Asn
    130             135             140


Asn Gly Phe Ala Ile Ser Ala Ala Leu Leu Met Ala Cys Ser Leu Gln
145             150             155             160


Ala Gly Ala Phe Glu Met Leu Ile Val Gly Arg Phe Ile Met Gly Ile
            165             170             175


Asp Gly Gly Val Ala Leu Ser Val Leu Pro Met Tyr Leu Ser Glu Ile
            180             185             190


Ser Pro Lys Glu Ile Arg Gly Ser Leu Gly Gln Val Thr Ala Ile Phe
    195             200             205


Ile Cys Ile Gly Val Phe Thr Gly Gln Leu Leu Gly Leu Pro Glu Leu
    210             215             220


Leu Gly Lys Glu Ser Thr Trp Pro Tyr Leu Phe Gly Val Ile Val Val
225             230             235             240


Pro Ala Val Val Gln Leu Leu Ser Leu Pro Phe Leu Pro Asp Ser Pro
            245             250             255


Arg Tyr Leu Leu Leu Glu Lys His Asn Glu Ala Arg Ala Val Lys Ala
            260             265             270


Phe Gln Thr Phe Leu Gly Lys Ala Asp Val Ser Gln Glu Val Glu Glu
            275             280             285


Val Leu Ala Glu Ser Arg Val Gln Arg Ser Ile Arg Leu Val Ser Val
    290             295             300


Leu Glu Leu Leu Arg Ala Pro Tyr Val Arg Trp Gln Val Val Thr Val
305             310             315             320
```

98

```
Ile Val Thr Met Ala Cys Tyr Gln Leu Cys Gly Leu Asn Ala Ile Trp
            325             330                 335


Phe Tyr Thr Asn Ser Ile Phe Gly Lys Ala Gly Ile Pro Leu Ala Lys
            340             345                 350


Ile Pro Tyr Val Thr Leu Ser Thr Gly Gly Ile Glu Thr Leu Ala Ala
            355             360                 365


Val Phe Ser Gly Leu Val Ile Glu His Leu Gly Arg Arg Pro Leu Leu
    370             375             380


Ile Gly Gly Phe Gly Leu Met Gly Leu Phe Phe Gly Thr Leu Thr Ile
385             390             395                 400


Thr Leu Thr Leu Gln Asp His Ala Pro Trp Val Pro Tyr Leu Ser Ile
            405             410                 415


Val Gly Ile Leu Ala Ile Ile Ala Ser Phe Cys Ser Gly Pro Gly Gly
            420             425             430


Ile Pro Phe Ile Leu Thr Gly Glu Phe Phe Gln Gln Ser Gln Arg Pro
            435             440             445


Ala Ala Phe Ile Ile Ala Gly Thr Val Asn Trp Leu Ser Asn Phe Ala
            450             455             460


Val Gly Leu Leu Phe Pro Phe Ile Gln Lys Ser Leu Asp Thr Tyr Cys
465             470             475                 480


Phe Leu Val Phe Ala Thr Ile Cys Ile Thr Gly Ala Ile Tyr Leu Tyr
            485             490                 495


Phe Val Leu Pro Glu Thr Lys Asn Arg Thr Tyr Ala Glu Ile Ser Gln
            500             505                 510


Ala Phe Ser Lys Arg Asn Lys Ala Tyr Pro Pro Glu Glu Lys Ile Asp
            515             520             525


Ser Ala Val Thr Asp Gly Lys Ile Asn Gly Arg Pro
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                                                           1

cac tcc cca cct gtc ctg cct ttg tgt gcc tct gtg tct ttg ctg ggt      106
His Ser Pro Pro Val Leu Pro Leu Cys Ala Ser Val Ser Leu Leu Gly
         5              10             15

ggc ctg acc ttt ggt tat gaa ctg gca gtc ata tca ggt gcc ctg ctg      154
Gly Leu Thr Phe Gly Tyr Glu Leu Ala Val Ile Ser Gly Ala Leu Leu
     20             25             30

cca ctg cag ctt gac ttt ggg cta agc tgc ttg gag cag gag ttc ctg      202
Pro Leu Gln Leu Asp Phe Gly Leu Ser Cys Leu Glu Gln Glu Phe Leu
35             40             45             50

gtg ggc agc ctg ctc ctg ggg gct ctc ctc gcc tcc ctg gtt ggt ggc      250
Val Gly Ser Leu Leu Leu Gly Ala Leu Leu Ala Ser Leu Val Gly Gly
             55             60             65

ttc ctc att gac tgc tat ggc agg aag caa gcc atc ctc ggg agc aac      298
Phe Leu Ile Asp Cys Tyr Gly Arg Lys Gln Ala Ile Leu Gly Ser Asn
             70             75             80

ttg gtg ctg ctg gca ggc agc ctg acc ctg ggc ctg gct ggt tcc ctg      346
Leu Val Leu Leu Ala Gly Ser Leu Thr Leu Gly Leu Ala Gly Ser Leu
             85             90             95

gcc tgg ctg gtc ctg ggc cgc gct gtg gtt ggc ttc gcc att tcc ctc      394
Ala Trp Leu Val Leu Gly Arg Ala Val Val Gly Phe Ala Ile Ser Leu
     100            105            110

tcc tcc atg gct tgc tgt atc tac gtg tca gag ctg gtg ggg cca cgg      442
Ser Ser Met Ala Cys Cys Ile Tyr Val Ser Glu Leu Val Gly Pro Arg
115            120            125            130

cag cgg gga gtg ctg gtg tcc ctc tat gag gca ggc atc acc gtg ggc      490
Gln Arg Gly Val Leu Val Ser Leu Tyr Glu Ala Gly Ile Thr Val Gly
             135            140            145

atc ctg ctc tcc tat gcc ctc aac tat gca ctg gct ggt acc ccc tgg      538
Ile Leu Leu Ser Tyr Ala Leu Asn Tyr Ala Leu Ala Gly Thr Pro Trp
             150            155            160

gga tgg agg cac atg ttc ggc tgg gcc act gca cct gct gtc ctg caa      586
Gly Trp Arg His Met Phe Gly Trp Ala Thr Ala Pro Ala Val Leu Gln
             165            170            175

tcc ctc agc ctc ctc ttc ctc cct gct ggt aca gat gag act gca aca      634
Ser Leu Ser Leu Leu Phe Leu Pro Ala Gly Thr Asp Glu Thr Ala Thr
     180            185            190

cac aag gac ctc atc cca ctc cag gga ggt gag gcc ccc aag ctg ggc      682
His Lys Asp Leu Ile Pro Leu Gln Gly Gly Glu Ala Pro Lys Leu Gly
195            200            205            210

ccg ggg agg cca cgg tac tcc ttt ctg gac ctc ttc agg gca cgc gat      730
Pro Gly Arg Pro Arg Tyr Ser Phe Leu Asp Leu Phe Arg Ala Arg Asp
             215            220            225
```

100

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aac atg cga ggc cgg acc aca gtg ggc ctg ggg ctg gtg ctc ttc cag      778
Asn Met Arg Gly Arg Thr Thr Val Gly Leu Gly Leu Val Leu Phe Gln
        230             235             240

caa cta aca ggg cag ccc aac gtg ctg tgc tat gcc tcc acc atc ttc      826
Gln Leu Thr Gly Gln Pro Asn Val Leu Cys Tyr Ala Ser Thr Ile Phe
        245             250             255

agc tcc gtt ggt ttc cat ggg gga tcc tca gcc gtg ctg gcc tct gtg      874
Ser Ser Val Gly Phe His Gly Gly Ser Ser Ala Val Leu Ala Ser Val
    260             265             270

ggg ctt ggc gca gtg aag gtg gca gct acc ctg acc gcc atg ggg ctg      922
Gly Leu Gly Ala Val Lys Val Ala Ala Thr Leu Thr Ala Met Gly Leu
275             280             285             290

gtg gac cgt gca ggc cgc agg gct ctg ttg cta gct ggc tgt gcc ctc      970
Val Asp Arg Ala Gly Arg Arg Ala Leu Leu Leu Ala Gly Cys Ala Leu
            295             300             305

atg gcc ctg tcc gtc agt ggc ata ggc ctc gtc agc ttt gcc gtg ccc     1018
Met Ala Leu Ser Val Ser Gly Ile Gly Leu Val Ser Phe Ala Val Pro
        310             315             320

atg gac tca ggc cca agc tgt ctg gct gtg ccc aat gcc acc ggg cag     1066
Met Asp Ser Gly Pro Ser Cys Leu Ala Val Pro Asn Ala Thr Gly Gln
        325             330             335

aca ggc ctc cct gga gac tct ggc ctg ctg cag gac tcc tct cta cct     1114
Thr Gly Leu Pro Gly Asp Ser Gly Leu Leu Gln Asp Ser Ser Leu Pro
    340             345             350

ccc att cca agg acc aat gag gac caa agg gag cca atc ttg tcc act     1162
Pro Ile Pro Arg Thr Asn Glu Asp Gln Arg Glu Pro Ile Leu Ser Thr
355             360             365             370

gct aag aaa acc aag ccc cat ccc aga tct gga gac ccc tca gcc cct     1210
Ala Lys Lys Thr Lys Pro His Pro Arg Ser Gly Asp Pro Ser Ala Pro
            375             380             385

cct cgg ctg gcc ctg agc tct gcc ctc cct ggg ccc cct ctg ccc gct     1258
Pro Arg Leu Ala Leu Ser Ser Ala Leu Pro Gly Pro Pro Leu Pro Ala
        390             395             400

cgg ggg cat gca ctg ctg cgc tgg acc gca ctg ctg tgc ctg atg gtc     1306
Arg Gly His Ala Leu Leu Arg Trp Thr Ala Leu Leu Cys Leu Met Val
        405             410             415

ttt gtc agt gcc ttc tcc ttt ggg ttt ggg cca gtg acc tgg ctt gtc     1354
Phe Val Ser Ala Phe Ser Phe Gly Phe Gly Pro Val Thr Trp Leu Val
        420             425             430

ctc agc gag atc tac cct gtg gag ata cga gga aga gcc ttc gcc ttc     1402
Leu Ser Glu Ile Tyr Pro Val Glu Ile Arg Gly Arg Ala Phe Ala Phe
435             440             445             450

tgc aac agc ttc aac tgg gcg gcc aac ctc ttc atc agc ctc tcc ttc     1450
Cys Asn Ser Phe Asn Trp Ala Ala Asn Leu Phe Ile Ser Leu Ser Phe
            455             460             465

ctc gat ctc att ggc acc atc ggc ttg tcc tgg acc ttc ctg ctc tac     1498
Leu Asp Leu Ile Gly Thr Ile Gly Leu Ser Trp Thr Phe Leu Leu Tyr
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101

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            470                  475                  480

gga ctg acc gct gtc ctc ggc ctg ggc ttc atc tat tta ttt gtt cct        1546
Gly Leu Thr Ala Val Leu Gly Leu Gly Phe Ile Tyr Leu Phe Val Pro
        485                  490                  495

gaa aca aaa ggc cag tcg ttg gca gag ata gac cag cag ttc cag aag        1594
Glu Thr Lys Gly Gln Ser Leu Ala Glu Ile Asp Gln Gln Phe Gln Lys
    500                  505                  510

aga cgg ttc acc ctg agc ttt ggc cac agg cag aac tcc act ggc atc        1642
Arg Arg Phe Thr Leu Ser Phe Gly His Arg Gln Asn Ser Thr Gly Ile
515                  520                  525                  530

ccg tac agc cgc atc gag atc tct gcg gcc tcc tga ggaatccgtc            1688
Pro Tyr Ser Arg Ile Glu Ile Ser Ala Ala Ser
                535                  540
```

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tgcctggaaa ttctggaact gtggctttgg cagaccatct ccagcatcct gcttcctagg     1748

ccccagagca caagttccag ctggtctttt gggagtggcc cctgccccca aaggtggtct     1808

gcttttgctg gggtaaaaag gatgaaagtc tgagaatgcc caactcttca ttttgagtct     1868

caggccctga aggttcctga ggatctagct tcatgcctca gtttccccat tgacttgcac     1928

atctctgcag tatttataag aagaatattc tatgaagtct ttgttgcacc atggactttt     1988

ctcaaagaat ctcaagggta ccaatcctgg caggaagtct ctcccgatat caccctaaa      2048

tccaaatgag gatatcatct tttctaatct cttttttcaa ctggctggga catttcgga     2108

aggggaagt ctctttttt actcttatca ttttttttt ttgaggtgga gtctcattct        2168

gttgcccagg ctggcctgat cttggctcac tgcaacctcc acctcctgag ttcaagcgat     2228

tcttgtgcct cagcctccta agcagctggg actacaggcg catgcaacca tacccagcta     2288

atttattttt agcagagatg gggtttcact gtgttggcca ggctggtcgt gaactcctga     2348

gctcaagtga tccacccacc tcagcctccc agagtgctag gattacaggc cttttgactc     2408

ttttatctga gttttattga·cccctctaat tctcttaccc agaatattta tccttcacca .   2468

gcaactctga ctctttgacg ggaggcctca gttctagtcc ttggtctgct ggtgtcattg     2528

ctgtaggaat gaccacgggc ctcagtttcc ccatttgtat aatgggaagc ctgtaccagg     2588

tcattcttaa gatttctcct gactccagtg agctggaatt ctaaatgctg gtctaggagc     2648

tgtctccagg atggtgcagg atggctttgc ggaaaggaga tgggtttgga ggccaacaaa     2708

cctgcttgtc aatattgcct ttgcctcttg gcagcccttg aacttgagta aataacaact     2768

ccctgaacct cagttcctc atctgcagaa tggggataat .tatgtcccag gggtatattt      2828

agaccctgtt tcctttcagg agggtcccca gctggtccag ggcctgggaa atttctactt     2888

atcctcatta cccaggtccc tcctttggac cctgtaaagg gtcagggtga atcagatggg     2948

ggactgagca agtagctatg actgcagatc atgtaaggaa gggactgaca agaagctccc     3008

agatgctggg gagaatgaag agctaaaata gatcctaggt gctggatgct ttgtcatcca     3068
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102

tgcgtgcaca tatgggtgct ggcagagccc ccaaggactc tggcctctcg agttctccta   3128

tcttctccat tctagatgct tcccttgtat ccagtgatgt gctggagctg gctttgccaa   3188

gcttgtgaga gctggttgct acattttcag gattttaca agttggtaaa cacagccatt   3248

ataaaaaatt aaatgattta aatttataat taagtaaatt acattaaaac aaaaaaatta   3308

tactcaaaat tcattactta attttactac ctgttactat tatctgtgct tttgaggcta   3368

tttctacata gtaactctta tggagaccta ggggagacac cgcgcatctc ttcctgattc   3428

cccactcaat gacatcatgt tagtctttgg ttgcttaact ggctgtgggg agtgtttttg   3488

tatcacaaag attagagagg actacacatc agggcttgat ttattgtttg ttgattttct   3548

agacttcaga acatgctgga taaaatgtca gtaatgcaaa ttaaacttta aagtatgtct   3608

tgtttgtagc caatacatgg tgtatagcac caaaaaatgg agggattatt cttccagtag   3668

ttgaacactg tcatccgttt cagctgacag ctgctcaaat catttaagaa ggagttctga   3728

cattcatttt cattgtttta cttttgtctt cctcactagt gtaaacaaaa atttcaacca   3788

gcattcatgc cgaacctata cccattcttc agtgcctagc tgtacagtta tcagggattt   3848

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acaaggtttg gcaaaaaaaa aaatattaac aaaatattct gtaagaatca attgtctata   3968

tggaatttag gataaagaat atttacaata aagaatattt acaataaaga gtttattatt   4028

atttgtaagt tgtgtgcaac aaacataccc tttatctctg taaaatttat acacacaaaa   4088

attaacaaaa gattctgtaa gaattaattg gctatatgga atttaggata gaatatttac   4148

aataaagagt atttacaat   4167

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Leu Gly Gly Leu Thr Phe Gly Tyr Glu Leu Ala Val Ile Ser Gly Ala
            20   25   30

Leu Leu Pro Leu Gln Leu Asp Phe Gly Leu Ser Cys Leu Glu Gln Glu
        35   40   45

Phe Leu Val Gly Ser Leu Leu Leu Gly Ala Leu Leu Ala Ser Leu Val
    50   55   60

Gly Gly Phe Leu Ile Asp Cys Tyr Gly Arg Lys Gln Ala Ile Leu Gly
65   70   75   80

Ser Asn Leu Val Leu Leu Ala Gly Ser Leu Thr Leu Gly Leu Ala Gly
            85   90   95

Ser Leu Ala Trp Leu Val Leu Gly Arg Ala Val Val Gly Phe Ala Ile
            100   105   110

Ser Leu Ser Ser Met Ala Cys Cys Ile Tyr Val Ser Glu Leu Val Gly
        115   120   125

Pro Arg Gln Arg Gly Val Leu Val Ser Leu Tyr Glu Ala Gly Ile Thr
    130   135   140

Val Gly Ile Leu Leu Ser Tyr Ala Leu Asn Tyr Ala Leu Ala Gly Thr
145   150   155   160

Pro Trp Gly Trp Arg His Met Phe Gly Trp Ala Thr Ala Pro Ala Val
            165   170   175

Leu Gln Ser Leu Ser Leu Leu Phe Leu Pro Ala Gly Thr Asp Glu Thr
            180   185   190

Ala Thr His Lys Asp Leu Ile Pro Leu Gln Gly Gly Glu Ala Pro Lys
        195   200   205

Leu Gly Pro Gly Arg Pro Arg Tyr Ser Phe Leu Asp Leu Phe Arg Ala
    210   215   220

Arg Asp Asn Met Arg Gly Arg Thr Thr Val Gly Leu Gly Leu Val Leu
225   230   235   240

Phe Gln Gln Leu Thr Gly Gln Pro Asn Val Leu Cys Tyr Ala Ser Thr
            245   250   255

Ile Phe Ser Ser Val Gly Phe His Gly Gly Ser Ser Ala Val Leu Ala
            260   265   270

Ser Val Gly Leu Gly Ala Val Lys Val Ala Ala Thr Leu Thr Ala Met
    275   280   285

Gly Leu Val Asp Arg Ala Gly Arg Arg Ala Leu Leu Leu Ala Gly Cys
    290   295   300

Ala Leu Met Ala Leu Ser Val Ser Gly Ile Gly Leu Val Ser Phe Ala
305   310   315   320

104

```
Val Pro Met Asp Ser Gly Pro Ser Cys Leu Ala Val Pro Asn Ala Thr
            325             330             335

Gly Gln Thr Gly Leu Pro Gly Asp Ser Gly Leu Leu Gln Asp Ser Ser
            340             345             350

Leu Pro Pro Ile Pro Arg Thr Asn Glu Asp Gln Arg Glu Pro Ile Leu
            355             360             365

Ser Thr Ala Lys Lys Thr Lys Pro His Pro Arg Ser Gly Asp Pro Ser
    370             375             380

Ala Pro Pro Arg Leu Ala Leu Ser Ser Ala Leu Pro Gly Pro Pro Leu
385             390             395             400

Pro Ala Arg Gly His Ala Leu Leu Arg Trp Thr Ala Leu Leu Cys Leu
            405             410             415

Met Val Phe Val Ser Ala Phe Ser Phe Gly Phe Gly Pro Val Thr Trp
            420             425             430

Leu Val Leu Ser Glu Ile Tyr Pro Val Glu Ile Arg Gly Arg Ala Phe
            435             440             445

Ala Phe Cys Asn Ser Phe Asn Trp Ala Ala Asn Leu Phe Ile Ser Leu
    450             455             460

Ser Phe Leu Asp Leu Ile Gly Thr Ile Gly Leu Ser Trp Thr Phe Leu
465             470             475             480

Leu Tyr Gly Leu Thr Ala Val Leu Gly Leu Gly Phe Ile Tyr Leu Phe
            485             490             495

Val Pro Glu Thr Lys Gly Gln Ser Leu Ala Glu Ile Asp Gln Gln Phe
            500             505             510

Gln Lys Arg Arg Phe Thr Leu Ser Phe Gly His Arg Gln Asn Ser Thr
    515             520             525

Gly Ile Pro Tyr Ser Arg Ile Glu Ile Ser Ala Ala Ser
    530             535             540
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                                             Met Arg Ala Leu Arg
                                             1                 5

aga ctg att cag ggc agg atc ctg ctc ctg acc atc tgc gct gcc ggc      162
Arg Leu Ile Gln Gly Arg Ile Leu Leu Leu Thr Ile Cys Ala Ala Gly
            10              15              20

att ggt ggg act ttt cag ttt ggc tat aac ctc tct atc atc aat gcc      210
Ile Gly Gly Thr Phe Gln Phe Gly Tyr Asn Leu Ser Ile Ile Asn Ala
            25              30              35

ccg acc ttg cac att cag gaa ttc acc aat gag aca tgg cag gcg cgt      258
Pro Thr Leu His Ile Gln Glu Phe Thr Asn Glu Thr Trp Gln Ala Arg
            40              45              50

act gga gag cca ctg ccc gat cac cta gtc ctg ctt atg tgg tcc ctc      306
Thr Gly Glu Pro Leu Pro Asp His Leu Val Leu Leu Met Trp Ser Leu
        55              60              65

atc gtg tct ctg tat ccc ctg gga ggc ctc ttt gga gca ctg ctt gca      354
Ile Val Ser Leu Tyr Pro Leu Gly Gly Leu Phe Gly Ala Leu Leu Ala
70              75              80                  85

ggt ccc ttg gcc atc acg ctg gga agg aag aag tcc ctc ctg gtg aat      402
Gly Pro Leu Ala Ile Thr Leu Gly Arg Lys Lys Ser Leu Leu Val Asn
            90              95              100

aac atc ttt gtg gtg tca gca gca atc ctg ttt gga ttc agc cgc aaa      450
Asn Ile Phe Val Val Ser Ala Ala Ile Leu Phe Gly Phe Ser Arg Lys
            105             110             115

gca ggc tcc ttt gag atg atc atg ctg gga aga ctg ctc gtg gga gtc      498
Ala Gly Ser Phe Glu Met Ile Met Leu Gly Arg Leu Leu Val Gly Val
            120             125             130

aat gca ggt gtg agc atg aac atc cag ccc atg tac ctg ggg gag agc      546
Asn Ala Gly Val Ser Met Asn Ile Gln Pro Met Tyr Leu Gly Glu Ser
            135             140             145

gcc cct aag gag ctc cga gga gct gtg gcc atg agc tca gcc atc ttt      594
Ala Pro Lys Glu Leu Arg Gly Ala Val Ala Met Ser Ser Ala Ile Phe
150             .       155.            160             165

acg gct ctg ggg atc gtg atg gga cag gtg gtc gga ctc agg gag ctc      642
Thr Ala Leu Gly Ile Val Met Gly Gln Val Val Gly Leu Arg Glu Leu
            170             175             180

cta ggt ggc cct cag gcc tgg ccc ctg ctg ctg gcc agc tgc ctg gtg      690
Leu Gly Gly Pro Gln Ala Trp Pro Leu Leu Leu Ala Ser Cys Leu Val
            185             190             195

ccc ggg gcg ctc cag ctc gcc tcc ctg cct ctg ctc cct gaa agc ccg      738
Pro Gly Ala Leu Gln Leu Ala Ser Leu Pro Leu Leu Pro Glu Ser Pro
            200             205             210
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cgc tac ctc ctc att gac tgt gga gac acc gag gcc tgc ctg gca gca      786
Arg Tyr Leu Leu Ile Asp Cys Gly Asp Thr Glu Ala Cys Leu Ala Ala
    215             220             225

cta cgg cgg ctc cgg ggc tcc ggg gac ttg gca ggg gag ctg gag gag      834
Leu Arg Arg Leu Arg Gly Ser Gly Asp Leu Ala Gly Glu Leu Glu Glu
230             235             240             245

ctg gag gag gag cgc gct gcc tgc cag ggc tgc cgt gcc cgg cgc cca      882
Leu Glu Glu Glu Arg Ala Ala Cys Gln Gly Cys Arg Ala Arg Arg Pro
            250             255             260

tgg gag ctg ttc cag cat cgg gcc ctg agg aga cag gtg aca agc ctc      930
Trp Glu Leu Phe Gln His Arg Ala Leu Arg Arg Gln Val Thr Ser Leu
            265             270             275

gtg gtt ctg ggc agt gcc atg gag ctc tgc ggg aat gac tcg gtg tac      978
Val Val Leu Gly Ser Ala Met Glu Leu Cys Gly Asn Asp Ser Val Tyr
            280             285             290

gcc tac gcc tcc tcc gtg ttc cgg aag gca gga gtg ccg gaa gcg aag     1026
Ala Tyr Ala Ser Ser Val Phe Arg Lys Ala Gly Val Pro Glu Ala Lys
    295             300             305

atc cag tac gcg atc atc ggg act ggg agc tgc gag ctg ctc acg gcg     1074
Ile Gln Tyr Ala Ile Ile Gly Thr Gly Ser Cys Glu Leu Leu Thr Ala
310             315             320             325

gtt gtt agt tgt gtg gta atc gag agg gtg ggt cgg cgc gtg ctg ctc     1122
Val Val Ser Cys Val Val Ile Glu Arg Val Gly Arg Arg Val Leu Leu
            330             335             340

atc ggt ggg tac agc ctg atg acc tgc tgg ggg agc atc ttc act gtg     1170
Ile Gly Gly Tyr Ser Leu Met Thr Cys Trp Gly Ser Ile Phe Thr Val
            345             350             355

gcc ctg tgc ctg cag agc tcc ttc ccc tgg aca ctc tac ctg gcc atg     1218
Ala Leu Cys Leu Gln Ser Ser Phe Pro Trp Thr Leu Tyr Leu Ala Met
            360             365             370

gcc tgc atc ttt gcc ttc atc ctc agc ttt ggc att ggc cct gcc gga     1266
Ala Cys Ile Phe Ala Phe Ile Leu Ser Phe Gly Ile Gly Pro Ala Gly
    375             380             385

gtg acg ggg atc ctg gcc aca gag ctg ttt gac cag atg gcc agg cct     1314
Val Thr Gly Ile Leu Ala Thr Glu Leu Phe Asp Gln Met Ala Arg Pro
390             395             400             405

gct gcc tgc atg gtc tgc ggg gcg ctc atg tgg atc atg ctc atc ctg     1362
Ala Ala Cys Met Val Cys Gly Ala Leu Met Trp Ile Met Leu Ile Leu
            410             415             420

gtc ggc ctg gga ttt ccc ttt atc atg gag gcc ttg tcc cac ttc ctc     1410
Val Gly Leu Gly Phe Pro Phe Ile Met Glu Ala Leu Ser His Phe Leu
            425             430             435

tat gtc cct ttc ctt ggt gtc tgt gtc tgt ggg gcc atc tac act ggc     1458
Tyr Val Pro Phe Leu Gly Val Cys Val Cys Gly Ala Ile Tyr Thr Gly
            440             445             450

ctg ttc ctt cct gag acc aaa ggc aag acc ttc caa gag atc tcc aag     1506
Leu Phe Leu Pro Glu Thr Lys Gly Lys Thr Phe Gln Glu Ile Ser Lys
    455             460             465
```

107

```
gaa tta cac aga ctc aac ttc ccc agg cgg gcc cag ggc ccc acg tgg      1554
Glu Leu His Arg Leu Asn Phe Pro Arg Arg Ala Gln Gly Pro Thr Trp
470             475         480             485

agg agc ctg gag gtt atc cag tca aca gaa ctc tag tcccaaaggg           1600
Arg Ser Leu Glu Val Ile Gln Ser Thr Glu Leu
        490             495

gtggccag                                                             1608
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<213> GLUT11

<400> 54

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Met Arg Ala Leu Arg Arg Leu Ile Gln Gly Arg Ile Leu Leu Leu Thr
1             5             10              15


Ile Cys Ala Ala Gly Ile Gly Gly Thr Phe Gln Phe Gly Tyr Asn Leu
            20              25              30


Ser Ile Ile Asn Ala Pro Thr Leu His Ile Gln Glu Phe Thr Asn Glu
        35              40              45


Thr Trp Gln Ala Arg Thr Gly Glu Pro Leu Pro Asp His Leu Val Leu
    50              55              60


Leu Met Trp Ser Leu Ile Val Ser Leu Tyr Pro Leu Gly Gly Leu Phe
65              70              75              80


Gly Ala Leu Leu Ala Gly Pro Leu Ala Ile Thr Leu Gly Arg Lys Lys
            85              90              95


Ser Leu Leu Val Asn Asn Ile Phe Val Val Ser Ala Ala Ile Leu Phe
            100             105             110


Gly Phe Ser Arg Lys Ala Gly Ser Phe Glu Met Ile Met Leu Gly Arg
        115             120             125


Leu Leu Val Gly Val Asn Ala Gly Val Ser Met Asn Ile Gln Pro Met
    130             135             140


Tyr Leu Gly Glu Ser Ala Pro Lys Glu Leu Arg Gly Ala Val Ala Met
145             150             155             160


Ser Ser Ala Ile Phe Thr Ala Leu Gly Ile Val Met Gly Gln Val Val
            165             170             175
```

Gly Leu Arg Glu Leu Leu Gly Gly Pro Gln Ala Trp Pro Leu Leu Leu
        180   185   190

Ala Ser Cys Leu Val Pro Gly Ala Leu Gln Leu Ala Ser Leu Pro Leu
        195   200   205

Leu Pro Glu Ser Pro Arg Tyr Leu Leu Ile Asp Cys Gly Asp Thr Glu
        210   215   220

Ala Cys Leu Ala Ala Leu Arg Arg Leu Arg Gly Ser Gly Asp Leu Ala
225   230   235   240

Gly Glu Leu Glu Glu Leu Glu Glu Glu Arg Ala Ala Cys Gln Gly Cys
                245   250   255

Arg Ala Arg Arg Pro Trp Glu Leu Phe Gln His Arg Ala Leu Arg Arg
            260   265   270

Gln Val Thr Ser Leu Val Val Leu Gly Ser Ala Met Glu Leu Cys Gly
        275   280   285

Asn Asp Ser Val Tyr Ala Tyr Ala Ser Ser Val Phe Arg Lys Ala Gly
        290   295   300

Val Pro Glu Ala Lys Ile Gln Tyr Ala Ile Ile Gly Thr Gly Ser Cys
305   310   315   320

Glu Leu Leu Thr Ala Val Val Ser Cys Val Val Ile Glu Arg Val Gly
            325   330   335

Arg Arg Val Leu Leu Ile Gly Gly Tyr Ser Leu Met Thr Cys Trp Gly
            340   345   350

Ser Ile Phe Thr Val Ala Leu Cys Leu Gln Ser Ser Phe Pro Trp Thr
        355   360   365

Leu Tyr Leu Ala Met Ala Cys Ile Phe Ala Phe Ile Leu Ser Phe Gly
        370   375   380

Ile Gly Pro Ala Gly Val Thr Gly Ile Leu Ala Thr Glu Leu Phe Asp
385   390   395   400

Gln Met Ala Arg Pro Ala Ala Cys Met Val Cys Gly Ala Leu Met Trp
            405   410   415

Ile Met Leu Ile Leu Val Gly Leu Gly Phe Pro Phe Ile Met Glu Ala
        420   425   430

109

```
Leu Ser His Phe Leu Tyr Val Pro Phe Leu Gly Val Cys Val Cys Gly
        435             440             445

Ala Ile Tyr Thr Gly Leu Phe Leu Pro Glu Thr Lys Gly Lys Thr Phe
    450             455             460

Gln Glu Ile Ser Lys Glu Leu His Arg Leu Asn Phe Pro Arg Arg Ala
465             470             475             480

Gln Gly Pro Thr Trp Arg Ser Leu Glu Val Ile Gln Ser Thr Glu Leu
                485             490             495
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<210>  55
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<222>  (106)..(1959)
<223>

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ggggcggttt ggtggcgggg aagcggctgt aacttctacg tgacc atg gta cct gtt    117
                                               Met Val Pro Val
                                                1

gaa aac acc gag ggc ccc agt ctg ctg aac cag aag ggg aca gcc gtg      165
Glu Asn Thr Glu Gly Pro Ser Leu Leu Asn Gln Lys Gly Thr Ala Val
5              10              15              20

gag acg gag ggc agc ggc agc cgg cat cct ccc tgg gcg aga ggc tgc      213
Glu Thr Glu Gly Ser Gly Ser Arg His Pro Pro Trp Ala Arg Gly Cys
            25              30              35

ggc atg ttt acc ttc ctg tca tct gtc act gct gct gtc agt ggc ctc      261
Gly Met Phe Thr Phe Leu Ser Ser Val Thr Ala Ala Val Ser Gly Leu
            40              45              50

ctg gtg ggt tat gaa ctt ggg atc atc tct ggg gct ctt ctt cag atc      309
Leu Val Gly Tyr Glu Leu Gly Ile Ile Ser Gly Ala Leu Leu Gln Ile
        55              60              65

aaa acc tta tta gcc ctg agc tgc cat gag cag gaa atg gtt gtg agc      357
Lys Thr Leu Leu Ala Leu Ser Cys His Glu Gln Glu Met Val Val Ser
    70              75              80

tcc ctc gtc att gga gcc ctc ctt gcc tca ctc acc gga ggg gtc ctg      405
Ser Leu Val Ile Gly Ala Leu Leu Ala Ser Leu Thr Gly Gly Val Leu
85              90              95              100

ata gac aga tat gga aga agg aca gca atc atc ttg tca tcc tgc ctg      453
Ile Asp Arg Tyr Gly Arg Arg Thr Ala Ile Ile Leu Ser Ser Cys Leu
            105             110             115

ctt gga ctc gga agc tta gtc ttg atc ctc agt tta tcc tac acg gtt      501
```

110

```
Leu Gly Leu Gly Ser Leu Val Leu Ile Leu Ser Leu Ser Tyr Thr Val
        120           ·          125           130

ctt ata gtg gga cgc att gcc ata ggg gtc tcc atc tcc ctc tct tcc      549
Leu Ile Val Gly Arg Ile Ala Ile Gly Val Ser Ile Ser Leu Ser Ser
        135               140               145

att gcc act tgt gtt tac atc gca gag att gct cct caa cac aga aga      597
Ile Ala Thr Cys Val Tyr Ile Ala Glu Ile Ala Pro Gln His Arg Arg
    150               155               160
  ·

ggc ctt ctt gtg tca ctg aat gag ctg atg att gtc atc ggc att ctt      645
Gly Leu Leu Val Ser Leu Asn Glu Leu Met Ile Val Ile Gly Ile Leu
165               170               175               180

tct gcc tat att tca aat tac gca ttt gcc aat gtt ttc cat ggc tgg      693
Ser Ala Tyr Ile Ser Asn Tyr Ala Phe Ala Asn Val Phe His Gly Trp
                185               190               195

aag tac atg ttt ggt ctt gtg att ccc ttg gga gtt ttg caa gca att      741
Lys Tyr Met Phe Gly Leu Val Ile Pro Leu Gly Val Leu Gln Ala Ile
                200               205               210

gca atg tat ttt ctt cct cca agc cct cgg ttt ctg gtg atg aaa gga      789
Ala Met Tyr Phe Leu Pro Pro Ser Pro Arg Phe Leu Val Met Lys Gly
            215               220               225

caa gag gga gct gct agc aag gtt ctt gga agg tta aga gca ctc tca      837
Gln Glu Gly Ala Ala Ser Lys Val Leu Gly Arg Leu Arg Ala Leu Ser  .
        230               235               240

gat aca act gag gaa ctc act gtg atc aaa tcc tcc ctg aaa gat gaa      885
Asp Thr Thr Glu Glu Leu Thr Val Ile Lys Ser Ser Leu Lys Asp Glu
245               250               255               260

tat cag tac agt ttt tgg gat ctg ttt cgt tca aaa gac aac atg cgg      933
Tyr Gln Tyr Ser Phe Trp Asp Leu Phe Arg Ser Lys Asp Asn Met Arg
                265               270               275

acc cga ata atg ata gga cta aca cta gta ttt ttt gta caa atc act      981
Thr Arg Ile Met Ile Gly Leu Thr Leu Val Phe Phe Val Gln Ile Thr
                280               285               290

ggc caa cca aac ata ttg ttc tat gca tca act gtt ttg aag tca gtt     1029
Gly Gln Pro Asn Ile Leu Phe Tyr Ala Ser Thr Val Leu Lys Ser Val
            295               300               305

gga ttt caa agc aat gag gca gct agc ctc gcc tcc act ggg gtt gga     1077
Gly Phe Gln Ser Asn Glu Ala Ala Ser Leu Ala Ser Thr Gly Val Gly
        310               315               320

gtc gtc aag gtc att agc acc atc cct gcc act ctt ctt gta gac cat     1125
Val Val Lys Val Ile Ser Thr Ile Pro Ala Thr Leu Leu Val Asp His
325               330               335               340

gtt ggc agc aaa aca ttc ctc tgc att ggc tcc tct gtg atg gca gct     1173
Val Gly Ser Lys Thr Phe Leu Cys Ile Gly Ser Ser Val Met Ala Ala
                345               350               355

tcg ttg gtg acc atg ggc atc gta aat ctc aac atc cac atg aac ttc     1221
Ser Leu Val Thr Met Gly Ile Val Asn Leu Asn Ile His Met Asn Phe
                360               365               370
```

111

```
acc cat atc tgc aga agc cac aat tct atc aac cag tcc ttg gat gag        1269
Thr His Ile Cys Arg Ser His Asn Ser Ile Asn Gln Ser Leu Asp Glu
        375               .       380               385

tct gtg att tat gga cca gga aac ctg tca acc aac aac aat act ctc        1317
Ser Val Ile Tyr Gly Pro Gly Asn Leu Ser Thr Asn Asn Asn Thr Leu
        390               395               400

aga gac cac ttc aaa ggg att tct tcc cat agc aga agc tca ctc atg        1365
Arg Asp His Phe Lys Gly Ile Ser Ser His Ser Arg Ser Ser Leu Met
405               410               415               420

ccc ctg aga aat gat gtg gat aag aga ggg gag acg acc tca gca tcc        1413
Pro Leu Arg Asn Asp Val Asp Lys Arg Gly Glu Thr Thr Ser Ala Ser
                425               430               435

ttg cta aat gct gga tta agc cac act gaa tac cag ata gtc aca gac        1461
Leu Leu Asn Ala Gly Leu Ser His Thr Glu Tyr Gln Ile Val Thr Asp
            440               445               450

cct ggg gac gtc cca gct ttt ttg aaa tgg ctg tcc tta gcc agc ttg        1509
Pro Gly Asp Val Pro Ala Phe Leu Lys Trp Leu Ser Leu Ala Ser Leu
            455               460               465

ctt gtt tat gtt gct gct ttt tca att ggt cta gga cca atg ccc tgg        1557
Leu Val Tyr Val Ala Ala Phe Ser Ile Gly Leu Gly Pro Met Pro Trp
        470               475               480

ctg gtg ctc agc gag atc ttt cct ggt ggg atc aga gga cga gcc atg        1605
Leu Val Leu Ser Glu Ile Phe Pro Gly Gly Ile Arg Gly Arg Ala Met
485               490               495               500

gct tta act tct agc atg aac tgg ggc atc aat ctc ctc atc tcg ctg        1653
Ala Leu Thr Ser Ser Met Asn Trp Gly Ile Asn Leu Leu Ile Ser Leu
                505               510               515

aca ttt ttg act gta act gat ctt att ggc ctg cca tgg gtg tgc ttt        1701
Thr Phe Leu Thr Val Thr Asp Leu Ile Gly Leu Pro Trp Val Cys Phe
            520               525               530

ata tat aca atc atg agt cta gca tcc ctg ctt ttt gtt gtt atg ttt        1749
Ile Tyr Thr Ile Met Ser Leu Ala Ser Leu Leu Phe Val Val Met Phe
            535               540               545

ata cct gag aca aag gga tgc tct ttg gaa caa ata tca atg gag cta        1797
Ile Pro Glu Thr Lys Gly Cys Ser Leu Glu Gln Ile Ser Met Glu Leu
        550               555               560

gca aaa gtg aac tat gtg aaa aac aac att tgt ttt atg agt cat cac        1845
Ala Lys Val Asn Tyr Val Lys Asn Asn Ile Cys Phe Met Ser His His
565               570               575               580

caa gaa gaa tta gtg cca aaa cag cct caa aaa aga aaa ccc cag gag        1893
Gln Glu Glu Leu Val Pro Lys Gln Pro Gln Lys Arg Lys Pro Gln Glu
                585               590               595

cag ctc ttg gag tgt aac aag ctg tgt ggt agg ggc caa tcc agg cag        1941
Gln Leu Leu Glu Cys Asn Lys Leu Cys Gly Arg Gly Gln Ser Arg Gln
            600               605               610

ctt tct cca gag acc taa tggcctcaac accttctgaa cgtggatagt              1989
Leu Ser Pro Glu Thr
        615
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gccagaacac ttaggagggt gtctttggac caatgcatag ttgcgactcc tgtgctctct    2049

tttcagtgtc atggaactgg ttttgaagag acactctgaa atgataaaga cagcctttaa    2109

tccccctcct ccccagaagg aacctcaaaa ggtagatgag gtacaaggtc ctaagtgatc    2169

tcttttctg agcaggatat caggcaaaaa aaaaaaaaaa aaaaaaaaa aaaa             2223
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<213> GLUT12

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Met Val Pro Val Glu Asn Thr Glu Gly Pro Ser Leu Leu Asn Gln Lys
1               5                   10                  15


Gly Thr Ala Val Glu Thr Glu Gly Ser Gly Ser Arg His Pro Pro Trp
            20                  25                  30


Ala Arg Gly Cys Gly Met Phe Thr Phe Leu Ser Ser Val Thr Ala Ala
        35                  40                  45


Val Ser Gly Leu Leu Val Gly Tyr Glu Leu Gly Ile Ile Ser Gly Ala
    50                  55                  60


Leu Leu Gln Ile Lys Thr Leu Leu Ala Leu Ser Cys His Glu Gln Glu
65                  70                  75                  80


Met Val Val Ser Ser Leu Val Ile Gly Ala Leu Leu Ala Ser Leu Thr
                85                  90                  95


Gly Gly Val Leu Ile Asp Arg Tyr Gly Arg Arg Thr Ala Ile Ile Leu
                100                 105                 110


Ser Ser Cys Leu Leu Gly Leu Gly Ser Leu Val Leu Ile Leu Ser Leu
        115                 120                 125


Ser Tyr Thr Val Leu Ile Val Gly Arg Ile Ala Ile Gly Val Ser Ile
    130                 135                 140


Ser Leu Ser Ser Ile Ala Thr Cys Val Tyr Ile Ala Glu Ile Ala Pro
145                 150                 155                 160


Gln His Arg Arg Gly Leu Leu Val Ser Leu Asn Glu Leu Met Ile Val
                165                 170                 175


Ile Gly Ile Leu Ser Ala Tyr Ile Ser Asn Tyr Ala Phe Ala Asn Val
                180                 185                 190
```

113

Phe His Gly Trp Lys Tyr Met Phe Gly Leu Val Ile Pro Leu Gly Val
        195   200   205

Leu Gln Ala Ile Ala Met Tyr Phe Leu Pro Pro Ser Pro Arg Phe Leu
    210   215   220

Val Met Lys Gly Gln Glu Gly Ala Ala Ser Lys Val Leu Gly Arg Leu
225   230   235   240

Arg Ala Leu Ser Asp Thr Thr Glu Glu Leu Thr Val Ile Lys Ser Ser
            245   250   255

Leu Lys Asp Glu Tyr Gln Tyr Ser Phe Trp Asp Leu Phe Arg Ser Lys
        260   265   270

Asp Asn Met Arg Thr Arg Ile Met Ile Gly Leu Thr Leu Val Phe Phe
        275   280   285

Val Gln Ile Thr Gly Gln Pro Asn Ile Leu Phe Tyr Ala Ser Thr Val
    290   295   300

Leu Lys Ser Val Gly Phe Gln Ser Asn Glu Ala Ala Ser Leu Ala Ser
305   310   315   320

Thr Gly Val Gly Val Val Lys Val Ile Ser Thr Ile Pro Ala Thr Leu
            325   330   335

Leu Val Asp His Val Gly Ser Lys Thr Phe Leu Cys Ile Gly Ser Ser
            340   345   350

Val Met Ala Ala Ser Leu Val Thr Met Gly Ile Val Asn Leu Asn Ile
        355   360   365

His Met Asn Phe Thr His Ile Cys Arg Ser His Asn Ser Ile Asn Gln
    370   375   380

Ser Leu Asp Glu Ser Val Ile Tyr Gly Pro Gly Asn Leu Ser Thr Asn
385   390   395   400

Asn Asn Thr Leu Arg Asp His Phe Lys Gly Ile Ser Ser His Ser Arg
            405   410   415

Ser Ser Leu Met Pro Leu Arg Asn Asp Val Asp Lys Arg Gly Glu Thr
        420   425   430

Thr Ser Ala Ser Leu Leu Asn Ala Gly Leu Ser His Thr Glu Tyr Gln

```
              435                440                445

    Ile Val Thr Asp Pro Gly Asp Val Pro Ala Phe Leu Lys Trp Leu Ser
         450                455                460

    Leu Ala Ser Leu Leu Val Tyr Val Ala Ala Phe Ser Ile Gly Leu Gly
    465                470                475                480

    Pro Met Pro Trp Leu Val Leu Ser Glu Ile Phe Pro Gly Gly Ile Arg
                   485                490                495

    Gly Arg Ala Met Ala Leu Thr Ser Ser Met Asn Trp Gly Ile Asn Leu
                   500                505                510

    Leu Ile Ser Leu Thr Phe Leu Thr Val Thr Asp Leu Ile Gly Leu Pro
             515                520                525

    Trp Val Cys Phe Ile Tyr Thr Ile Met Ser Leu Ala Ser Leu Leu Phe
         530                535                540

    Val Val Met Phe Ile Pro Glu Thr Lys Gly Cys Ser Leu Glu Gln Ile
    545                550                555                560

    Ser Met Glu Leu Ala Lys Val Asn Tyr Val Lys Asn Asn Ile Cys Phe
                   565                570                575

    Met Ser His His Gln Glu Glu Leu Val Pro Lys Gln Pro Gln Lys Arg
                   580                585                590

    Lys Pro Gln Glu Gln Leu Leu Glu Cys Asn Lys Leu Cys Gly Arg Gly
             595                600                605

    Gln Ser Arg Gln Leu Ser Pro Glu Thr
         610                615


    <210>  57
    <211>  3261
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    <213>  GLUT13 (HMIT)

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    <222>  (109)..(1998)
    <223>

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    aaggcaagcg agaatgtgga gtacacgctg cggagcctga gcagcctg atg ggc gag     117
                                                          Met Gly Glu
                                                            1
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cgg cgc agg aag cag ccg gag ccg gac gcg gcg agc gcg gcc ggg gag        165
Arg Arg Arg Lys Gln Pro Glu Pro Asp Ala Ala Ser Ala Ala Gly Glu
    5                   10              15

tgc agc ctc ctg gct gcc gcc gaa tcg agc acc agc ctg cag agc gcg        213
Cys Ser Leu Leu Ala Ala Ala Glu Ser Ser Thr Ser Leu Gln Ser Ala
20                  25              30              35

ggc gcg ggc ggc ggc ggc gtc ggg gac ctg gag cgc gcg gcg cgg cgg        261
Gly Ala Gly Gly Gly Gly Val Gly Asp Leu Glu Arg Ala Ala Arg Arg
                40              45              50

cag ttc cag cag gac gag acc ccc gcc ttc gtg tac gtg gtg gcc gtc        309
Gln Phe Gln Gln Asp Glu Thr Pro Ala Phe Val Tyr Val Val Ala Val
                55              60              65

ttc tcc gcg ctg ggc ggc ttc ctg ttt ggc tat gac acc ggg gtg gtg        357
Phe Ser Ala Leu Gly Gly Phe Leu Phe Gly Tyr Asp Thr Gly Val Val
        70              75              80

tca ggg gcc atg ctg ctg ctc aag cgg cag ctc agt ctg gac gcg ctg        405
Ser Gly Ala Met Leu Leu Leu Lys Arg Gln Leu Ser Leu Asp Ala Leu
        85              90              95

tgg cag gag ctg ctg gtg tcc agc acg gtg ggg gcg gct gcc gtc tcg        453
Trp Gln Glu Leu Leu Val Ser Ser Thr Val Gly Ala Ala Ala Val Ser
100                 105             110·            115

gcg ctg gcc gga ggc gcc ctc aac ggc gtc ttc ggc cgc cgc gct gcc        501
Ala Leu Ala Gly Gly Ala Leu Asn Gly Val Phe Gly Arg Arg Ala Ala
                120             125             130

atc ctc ctg gcc agt gcc ctc ttc acc gcc ggc tcc gcg gtg ctg gct        549
Ile Leu Leu Ala Ser Ala Leu Phe Thr Ala Gly Ser Ala Val Leu Ala
            135         ·           140             145

gcg gcc aac aac aag gag aca ctg ctc gcc ggc cgc ctg gtc gtg gga        597
Ala Ala Asn Asn Lys Glu Thr Leu Leu Ala Gly Arg Leu Val Val Gly
            150             155             160

ctc ggc atc ggc att gct tct atg aca gtg cca gtg tac att gcg gag        645
Leu Gly Ile Gly Ile Ala Ser Met Thr Val Pro Val Tyr Ile Ala Glu
            165             170             175

gtc tca cca ccc aat tta aga ggc cga tta gtc acc att aat acc ctc        693
Val Ser Pro Pro Asn Leu Arg Gly Arg Leu Val Thr Ile Asn Thr Leu
180                 185             190             195

ttc atc aca gga ggg cag ttc ttt gca agt gtt gtt gat gga gcc ttc        741
Phe Ile Thr Gly Gly Gln Phe Phe Ala Ser Val Val Asp Gly Ala Phe
                200             205             210

agt tat ctc cag aag gat gga tgg agg tac atg ttg gga ctt gca rca        789
Ser Tyr Leu Gln Lys Asp Gly Trp Arg Tyr Met Leu Gly Leu Ala Xaa
            215             220             225

gtt ccg gcg gtt ata cag ttt ttt ggc ttt ctc ttt ttg cct gaa agc        837
Val Pro Ala Val Ile Gln Phe Phe Gly Phe Leu Phe Leu Pro Glu Ser
            230             235             240

cct cga tgg ctt att cag aaa gga cag act cag aag gcc cgt aga att        885
Pro Arg Trp Leu Ile Gln Lys Gly Gln Thr Gln Lys Ala Arg Arg Ile
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116

	245						250					255				

```
tta tct cag atg cgt ggt aac cag acc att gat gag gaa tat gat agc      933
Leu Ser Gln Met Arg Gly Asn Gln Thr Ile Asp Glu Glu Tyr Asp Ser
260             265             270             275

atc aaa aac aac att gaa gag gag gaa aaa gag gtt ggc tca gct gga      981
Ile Lys Asn Asn Ile Glu Glu Glu Glu Lys Glu Val Gly Ser Ala Gly
                280             285             290

cct gtg atc tgc aga atg ctg agt tat ccc cca act cgc cga gct tta     1029
Pro Val Ile Cys Arg Met Leu Ser Tyr Pro Pro Thr Arg Arg Ala Leu
                295             300             305

att gtg ggt tgt ggc cta caa atg ttc cag cag ctc tca ggc att aac     1077
Ile Val Gly Cys Gly Leu Gln Met Phe Gln Gln Leu Ser Gly Ile Asn
                310             315             320

acc atc atg tac tac agt gca acc att ctg cag atg tct ggt gtt gaa     1125
Thr Ile Met Tyr Tyr Ser Ala Thr Ile Leu Gln Met Ser Gly Val Glu
            325             330             335

gat gat aga ctt gca ata tgg ctg gct tca gtt aca gcc ttc aca aat     1173
Asp Asp Arg Leu Ala Ile Trp Leu Ala Ser Val Thr Ala Phe Thr Asn
340             345             350             355

ttc att ttc aca ctt gtg gga gtc tgg ctt gtt gag aag gtg ggc cgc     1221
Phe Ile Phe Thr Leu Val Gly Val Trp Leu Val Glu Lys Val Gly Arg
                360             365             370

aga aag ctt acc ttt ggt agt tta gca ggt acc acc gta gca ctc att     1269
Arg Lys Leu Thr Phe Gly Ser Leu Ala Gly Thr Thr Val Ala Leu Ile
                375             380             385

att ctt gcc ttg gga ttt gtg cta tca gcc caa gtt tcc cca cgc atc     1317
Ile Leu Ala Leu Gly Phe Val Leu Ser Ala Gln Val Ser Pro Arg Ile
            390             395             400

act ttt aag cca ata gct ccg tca ggt cag aac gcc act tgc aca aga     1365
Thr Phe Lys Pro Ile Ala Pro Ser Gly Gln Asn Ala Thr Cys Thr Arg
            405             410             415

tac agt tac tgt aat gaa tgt atg ttg gat cca gac tgc ggt ttc tgc     1413
Tyr Ser Tyr Cys Asn Glu Cys Met Leu Asp Pro Asp Cys Gly Phe Cys
420             425             430             435

twc aag atg aac aaa tca act gtc att gac tcc tcc tgt gtt cca gtt     1461
Xaa Lys Met Asn Lys Ser Thr Val Ile Asp Ser Ser Cys Val Pro Val
                440             445             450

aat aaa gca tct aca aat gag gca gcc tgg ggc agg tgt gaa aat gaa     1509
Asn Lys Ala Ser Thr Asn Glu Ala Ala Trp Gly Arg Cys Glu Asn Glu
                455             460             465

acc aag ttc aaa aca gaa gat ata ttt tgg gct tac aat ttc tgc cct     1557
Thr Lys Phe Lys Thr Glu Asp Ile Phe Trp Ala Tyr Asn Phe Cys Pro
            470             475             480

act cca tac tcc tgg act gca ctt ctg ggc ctt att tta tat ctt gtc     1605
Thr Pro Tyr Ser Trp Thr Ala Leu Leu Gly Leu Ile Leu Tyr Leu Val
            485             490             495

ttc ttt gca cct gga atg gga cca atg cct tgg act gtg aat tct gaa     1653
```

```
Phe Phe Ala Pro Gly Met Gly Pro Met Pro Trp Thr Val Asn Ser Glu
500             505             510                 515

ata tat ccc ctt tgg gca aga agt aca gga aat gca tgt tca tct gga    1701
Ile Tyr Pro Leu Trp Ala Arg Ser Thr Gly Asn Ala Cys Ser Ser Gly
                520             525                 530

ata aac tgg att ttc aat gtc ctg gtt tca cta aca ttt tta cac aca    1749
Ile Asn Trp Ile Phe Asn Val Leu Val Ser Leu Thr Phe Leu His Thr
                535             540                 545

gca gag tat ctt aca tac tat gga gct ttc ttc ctc tat gct gga ttt    1797
Ala Glu Tyr Leu Thr Tyr Tyr Gly Ala Phe Phe Leu Tyr Ala Gly Phe
        550             555                 560

gct gct gtg gga ctc ctt ttc atc tat ggc tgt ctt cct gag acc aaa    1845
Ala Ala Val Gly Leu Leu Phe Ile Tyr Gly Cys Leu Pro Glu Thr Lys
    565             570                 575

ggc aaa aaa tta gag gaa att gaa tca ctc ttt gac aac agg cta tgt    1893
Gly Lys Lys Leu Glu Glu Ile Glu Ser Leu Phe Asp Asn Arg Leu Cys
580             585                 590                 595

aca tgt ggc act tca gat tct gat gaa ggg aga tat att gaa tat att    1941
Thr Cys Gly Thr Ser Asp Ser Asp Glu Gly Arg Tyr Ile Glu Tyr Ile
            600             605                 610

cgg gta aag gga agt aac tat cat ctt tct gac aat gat gct tct gat    1989
Arg Val Lys Gly Ser Asn Tyr His Leu Ser Asp Asn Asp Ala Ser Asp
            615             620                 625

gtg gaa taa ttttcagctg ctcatatatt tagttatttta aacaaactgg          2038
Val Glu


ggggagaaga acagcaattg gtgacttcac tgccctgctt ctaatctggt tctttccaca   2098

gcctagtttt gattgacttc atattctaga atacttgatt aggaggaaga tacaaccatg   2158

atgactttt tttccacaa ggaacaatat tttaaaaaat atttacagag attttaatct     2218

aataattctt aagcaaatgt gtgtaatgcc ttcctgaaat agtctaaaat gaatattgta   2278

cccagtgact tcagtggtat ccttttttcc taagaccatt tataattatt agtggcaaca   2338

gagtcagtgc taatctagcc aaattacata tgtataatat atttataaag gattctggga   2398

gatggtccaa gggtgttctg tgtcaaaaga tggcctattg gccctcagtt ttcctacaga   2458

gtagtggctt atctctgatc agctgttaca aactaaattc catgtaagct ttcatcaaca   2518

aattccaaag tgcctcctac aagggcacag ctgtccgtat ctcctttgga ttccatattt   2578

ttgtttctct ccaattcaga tattgggagt tcttcagata ctgactctgc acactatctt   2638

ttgaacatta tgaaaatata atctgtcggg ttgtttttcat acttccttt tttgcatcag    2698

tgataaggca tacatttgcg cagatgagct aggaagtttt gagaagtacc ttttatgttc   2758

agaaagtaac agattaaagg ttttttatggg ttccaaattg gttagtcact taggtatgca   2818

attataaatg caaaatagtg ccagatcttt aactgtatat cagggtcagt ttttgttcat   2878
```

118

```
gcccaaatca ctacaccttc ctcattggcc ttggagtcct actattttgt gccttcattt    2938

gtgttacata catagctgca agcaaaccat ttttcccctt tcttttattc aaacaataat    2998

ttttgaaaca aaaagagga aggaaatcag tggcagaaat aatcctgctg ttattggtgt     3058

ttgtttaata aaaataatgg gactttttc ttaacttttt attagctctt cctaagggaa     3118

atgtcacata ttattattta attgtacttg tctttttta ctttaagagc ataaactcgt     3178

ttttattttg cacacttttc tcattttcct gagaatttac cagaaaaaaa aagatacata    3238

gatttgtctc tgtgttttc.tta                                            3261
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<210> 58
<211> 629
<212> PRT
<213> GLUT13 (HMIT)

<220>
<221> misc_feature
<222> (227)..(227)
<223> The 'Xaa' at location 227 stands for Ala, or Thr.

<220>
<221> misc_feature
<222> (436)..(436)
<223> The 'Xaa' at location 436 stands for Tyr, or Phe.

<400> 58

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Met Gly Glu Arg Arg Arg Lys Gln Pro Glu Pro Asp Ala Ala Ser Ala
1               5               10              15


Ala Gly Glu Cys Ser Leu Leu Ala Ala Ala Glu Ser Ser Thr Ser Leu
            20              25              30


Gln Ser Ala Gly Ala Gly Gly Gly Gly Val Gly Asp Leu Glu Arg Ala
        35              40              45


Ala Arg Arg Gln Phe Gln Gln Asp Glu Thr Pro Ala Phe Val Tyr Val
    50              55              60


Val Ala Val Phe Ser Ala Leu Gly Gly Phe Leu Phe Gly Tyr Asp Thr
65              70              75              80


Gly Val Val Ser Gly Ala Met Leu Leu Leu Lys Arg Gln Leu Ser Leu
            85              90              95


Asp Ala Leu Trp Gln Glu Leu Leu Val Ser Ser Thr Val Gly Ala Ala
            100             105             110


Ala Val Ser Ala Leu Ala Gly Gly Ala Leu Asn Gly Val Phe Gly Arg
        115             120             125
```

Arg Ala Ala Ile Leu Leu Ala Ser Ala Leu Phe Thr Ala Gly Ser Ala
    130   135   140

Val Leu Ala Ala Ala Asn Asn Lys Glu Thr Leu Leu Ala Gly Arg Leu
145   150   155   160

Val Val Gly Leu Gly Ile Gly Ile Ala Ser Met Thr Val Pro Val Tyr
            165   170   175

Ile Ala Glu Val Ser Pro Pro Asn Leu Arg Gly Arg Leu Val Thr Ile
            180   185   190

Asn Thr Leu Phe Ile Thr Gly Gly Gln Phe Phe Ala Ser Val Val Asp
    195   200   205

Gly Ala Phe Ser Tyr Leu Gln Lys Asp Gly Trp Arg Tyr Met Leu Gly
    210   215   220

Leu Ala Xaa Val Pro Ala Val Ile Gln Phe Phe Gly Phe Leu Phe Leu
225   230   235   240

Pro Glu Ser Pro Arg Trp Leu Ile Gln Lys Gly Gln Thr Gln Lys Ala
            245   250   255

Arg Arg Ile Leu Ser Gln Met Arg Gly Asn Gln Thr Ile Asp Glu Glu
            260   265   270

Tyr Asp Ser Ile Lys Asn Asn Ile Glu Glu Glu Glu Lys Glu Val Gly
    275   280   285

Ser Ala Gly Pro Val Ile Cys Arg Met Leu Ser Tyr Pro Pro Thr Arg
    290   295   300

Arg Ala Leu Ile Val Gly Cys Gly Leu Gln Met Phe Gln Gln Leu Ser
305   310   315   320

Gly Ile Asn Thr Ile Met Tyr Tyr Ser Ala Thr Ile Leu Gln Met Ser
            325   330   335

Gly Val Glu Asp Asp Arg Leu Ala Ile Trp Leu Ala Ser Val Thr Ala
            340   345   350

Phe Thr Asn Phe Ile Phe Thr Leu Val Gly Val Trp Leu Val Glu Lys
        355   360   365

Val Gly Arg Arg Lys Leu Thr Phe Gly Ser Leu Ala Gly Thr Thr Val
    370   375   380

```
Ala Leu Ile Ile Leu Ala Leu Gly Phe Val Leu Ser Ala Gln Val Ser
385             390             395             400

Pro Arg Ile Thr Phe Lys Pro Ile Ala Pro Ser Gly Gln Asn Ala Thr
            405             410             415

Cys Thr Arg Tyr Ser Tyr Cys Asn Glu Cys Met Leu Asp Pro Asp Cys
            420             425             430

Gly Phe Cys Xaa Lys Met Asn Lys Ser Thr Val Ile Asp Ser Ser Cys
            435         .       440             445

Val Pro Val Asn Lys Ala Ser Thr Asn Glu Ala Ala Trp Gly Arg Cys
        450             455             460

Glu Asn Glu Thr Lys Phe Lys Thr Glu Asp Ile Phe Trp Ala Tyr Asn
465             470             475             480

Phe Cys Pro Thr Pro Tyr Ser Trp Thr Ala Leu Leu Gly Leu Ile Leu
            485             490             495

Tyr Leu Val Phe Phe Ala Pro Gly Met Gly Pro Met Pro Trp Thr Val
        500             505             510

Asn Ser Glu Ile Tyr Pro Leu Trp Ala Arg Ser Thr Gly Asn Ala Cys
        515             520             525

Ser Ser Gly Ile Asn Trp Ile Phe Asn Val Leu Val Ser Leu Thr Phe
        530             535             540

Leu His Thr Ala Glu Tyr Leu Thr Tyr Tyr Gly Ala Phe Phe Leu Tyr
545             550             555             560

Ala Gly Phe Ala Ala Val Gly Leu Leu Phe Ile Tyr Gly Cys Leu Pro
            565             570         .       575

Glu Thr Lys Gly Lys Lys Leu Glu Glu Ile Glu Ser Leu Phe Asp Asn
            580             585             590

Arg Leu Cys Thr Cys Gly Thr Ser Asp Ser Asp Glu Gly Arg Tyr Ile
            595             600             605

Glu Tyr Ile Arg Val Lys Gly Ser Asn Tyr His Leu Ser Asp Asn Asp
            610             615             620

Ala Ser Asp Val Glu
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121

625

<210> 59
<211> 2118
<212> DNA
<213> GLUT14

<220>
<221> CDS
<222> (110)..(1603)
<223>

<400> 59
agcggggctg agcgaagccg cggggcccaa ccgcagtcgc ggggtctggg aggaagcagt   60

accttgaaga gaaattggag agggagtcaa ttcctaggat agcagagag atg gac aac   118
                                                         Met Asp Asn
                                                          1

aga cag aat gtc acc cca gct ctg atc ttt gcc atc aca gtt gct aca   166
Arg Gln Asn Val Thr Pro Ala Leu Ile Phe Ala Ile Thr Val Ala Thr
     5   10   15

atc ggc tct ttc cag ttt ggc tac aac act ggg gtc atc aat gct cct   214
Ile Gly Ser Phe Gln Phe Gly Tyr Asn Thr Gly Val Ile Asn Ala Pro
20   25   30   35

gag acg atc ata aag gaa ttt atc aat aaa act ttg acg gac aag gca   262
Glu Thr Ile Ile Lys Glu Phe Ile Asn Lys Thr Leu Thr Asp Lys Ala
                40   45   50

aat gcc cct ccc tct gag gtg ctg ctc acg aat ctc tgg tcc ttg tct   310
Asn Ala Pro Pro Ser Glu Val Leu Leu Thr Asn Leu Trp Ser Leu Ser
             55   60   65

gtg gcc ata ttt tcc gtc ggg ggt atg atc ggc tcc ttt tcc gtc gga   358
Val Ala Ile Phe Ser Val Gly Gly Met Ile Gly Ser Phe Ser Val Gly
         70   75   80

ctc ttt gtt aac cgc ttt ggc agg cgc aat tca atg ctg att gtc aac   406
Leu Phe Val Asn Arg Phe Gly Arg Arg Asn Ser Met Leu Ile Val Asn
     85   90   95

ctg ttg gct gcc act ggt ggc tgc ctt atg gga ctg tgt aaa ata gct   454
Leu Leu Ala Ala Thr Gly Gly Cys Leu Met Gly Leu Cys Lys Ile Ala
100   105   110   115

gag tca gtt gaa atg ctg atc ctg ggc cgc ttg gtt att ggc ctc ttc   502
Glu Ser Val Glu Met Leu Ile Leu Gly Arg Leu Val Ile Gly Leu Phe
                120   125   130

tgc gga ctc tgc aca ggt ttt gtg ccc atg tac att gga gag atc tcg   550
Cys Gly Leu Cys Thr Gly Phe Val Pro Met Tyr Ile Gly Glu Ile Ser
             135   140   145

cct act gcc ctg agg ggt gcc ttt ggc act ctc aac cag ctg ggc ata   598
Pro Thr Ala Leu Arg Gly Ala Phe Gly Thr Leu Asn Gln Leu Gly Ile
             150   155   160

gtt att gga att ctg gtg gcc cag atc ttt ggt ctg gaa ctc atc ctt   646
Val Ile Gly Ile Leu Val Ala Gln Ile Phe Gly Leu Glu Leu Ile Leu
         165   170   175

```
ggg tct gaa gag cta tgg ccg gtg cta tta ggc ttt acc atc ctt cca      694
Gly Ser Glu Glu Leu Trp Pro Val Leu Leu Gly Phe Thr Ile Leu Pro
180                 185                 190                 195

gct atc ctg caa agt gca gcc ctt cca tgt tgc cct gaa agt ccc aga      742
Ala Ile Leu Gln Ser Ala Ala Leu Pro Cys Cys Pro Glu Ser Pro Arg
                200                 205                 210

ttt ttg ctc att aac aga aaa aaa gag gag aat gct acg cgg atc ctc      790
Phe Leu Leu Ile Asn Arg Lys Lys Glu Glu Asn Ala Thr Arg Ile Leu
                215                 220                 225

cag cgg ttg tgg ggc acc cag gat gta tcc caa gac atc cag gag atg      838
Gln Arg Leu Trp Gly Thr Gln Asp Val Ser Gln Asp Ile Gln Glu Met
                230                 235                 240

aaa gat gag agt gca agg atg tca caa gaa aag caa gtc acc gtg ctg      886
Lys Asp Glu Ser Ala Arg Met Ser Gln Glu Lys Gln Val Thr Val Leu
                245                 250                 255

gag ctc ttt aga gtg tcc agc tac cga cag ccc atc atc att tcc att      934
Glu Leu Phe Arg Val Ser Ser Tyr Arg Gln Pro Ile Ile Ile Ser Ile
260                 265                 270                 275

gtg ctc cag ctc tct cag cag ctc tct ggg atc aat gct gtg ttc tat      982
Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala Val Phe Tyr
                280                 285                 290

tac tca aca gga atc ttc aag gat gca ggt gtt caa cag ccc atc tat     1030
Tyr Ser Thr Gly Ile Phe Lys Asp Ala Gly Val Gln Gln Pro Ile Tyr
                295                 300                 305

gcc acc atc agc gcg ggt gtg gtt aat act atc ttc act tta ctt tct     1078
Ala Thr Ile Ser Ala Gly Val Val Asn Thr Ile Phe Thr Leu Leu Ser
                310                 315                 320

cta ttt ctg gtg gaa agg gca gga aga agg act ctg cat atg ata ggc     1126
Leu Phe Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His Met Ile Gly
                325                 330                 335

ctt gga ggg atg gct ttt tgt tcc acg ctc atg act gtt tct ttg tta     1174
Leu Gly Gly Met Ala Phe Cys Ser Thr Leu Met Thr Val Ser Leu Leu
340                 345                 350                 355

tta aag aat cac tat aat ggg atg agc ttt gtc tgt att ggg gct atc     1222
Leu Lys Asn His Tyr Asn Gly Met Ser Phe Val Cys Ile Gly Ala Ile
                360                 365                 370

ttg gtc ttt gtg gcc tgt ttt gaa att gga cca ggc ccc att ccc tgg     1270
Leu Val Phe Val Ala Cys Phe Glu Ile Gly Pro Gly Pro Ile Pro Trp
                375                 380                 385

ttt att gtg gcc gaa ctc ttc agc cag ggc ccc cgc cca gct gcg atg     1318
Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro Ala Ala Met
                390                 395                 400

gca gtg gcc ggc tgc tcc aac tgg acc tcc aac ttc cta gtc gga ttg     1366
Ala Val Ala Gly Cys Ser Asn Trp Thr Ser Asn Phe Leu Val Gly Leu
405                 410                 415

ctc ttc ccc tct gct gct tac tat tta gga gcc tac gtt ttt att atc     1414
Leu Phe Pro Ser Ala Ala Tyr Tyr Leu Gly Ala Tyr Val Phe Ile Ile
```

```
           420                      425                      430                      435
ttc acc ggc ttc ctc att acc ttc ttg gcc ttt acc ttc ttc aaa gtc        1462
Phe Thr Gly Phe Leu Ile Thr Phe Leu Ala Phe Thr Phe Phe Lys Val
                440                      445                      450

cct gag acc cgt ggc agg act ttt gag gat atc aca cgg gcc ttt gaa        1510
Pro Glu Thr Arg Gly Arg Thr Phe Glu Asp Ile Thr Arg Ala Phe Glu
                455                      460                      465

ggg cag gca cac ggt gca gat aga tct ggg aag gac ggc gtc atg ggg        1558
Gly Gln Ala His Gly Ala Asp Arg Ser Gly Lys Asp Gly Val Met Gly
                470                      475                      480

atg aac agc atc gag cct gct aag gag acc acc acc aat gtc taa            1603
Met Asn Ser Ile Glu Pro Ala Lys Glu Thr Thr Thr Asn Val
        485                      490                      495

gtcatgcctc cttccacctc cctcccggca tgggaaagcc acctctccct caacaaggga      1663

gagactttat caggatgaac ccaggactgc ttctgaatgc tgctacttga tttctttctc      1723

atcccacgca ctccatgagc accccaaggc tgcagtttgt tggatcttca atggcttttt      1783

aaatttttatt tcctggacat cctcttctgc ttaggagaga ccgagtgaac ctaccttcat     1843

ttcaggaggg attggccgct tggcacatga caactttgcc agcttttcct cccttgggtt      1903

ctgatattgc cgcactagag gatataggag aggaaaagta aggtgcagtt gccccaacct      1963

cagacttacc aggaagcaga tacatatgag tgtggaagcc ggagggtgtt tatgtaagag      2023

caccttcctc acttccatac agctctacgc ggcaaattaa cttgagtttt atttatctta      2083

tcctctggtt taattacata aatatttatt tttta                                 2118
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<210>   60
<211>   497
<212>   PRT
<213>   GLUT14

<400>   60

Met Asp Asn Arg Gln Asn Val Thr Pro Ala Leu Ile Phe Ala Ile Thr
1               5                   10                  15


Val Ala Thr Ile Gly Ser Phe Gln Phe Gly Tyr Asn Thr Gly Val Ile
            20                  25                  30


Asn Ala Pro Glu Thr Ile Ile Lys Glu Phe Ile Asn Lys Thr Leu Thr
        35                  40                  45


Asp Lys Ala Asn Ala Pro Pro Ser Glu Val Leu Leu Thr Asn Leu Trp
    50                  55                  60


Ser Leu Ser Val Ala Ile Phe Ser Val Gly Gly Met Ile Gly Ser Phe
65                  70                  75                  80
```

124

```
Ser Val Gly Leu Phe Val Asn Arg Phe Gly Arg Arg Asn Ser Met Leu
              85              90              95

Ile Val Asn Leu Leu Ala Ala Thr Gly Gly Cys Leu Met Gly Leu Cys
              100             105             110

Lys Ile Ala Glu Ser Val Glu Met Leu Ile Leu Gly Arg Leu Val Ile
          115             120             125

Gly Leu Phe Cys Gly Leu Cys Thr Gly Phe Val Pro Met Tyr Ile Gly
    130             135             140

Glu Ile Ser Pro Thr Ala Leu Arg Gly Ala Phe Gly Thr Leu Asn Gln
145             150             155             160

Leu Gly Ile Val Ile Gly Ile Leu Val Ala Gln Ile Phe Gly Leu Glu
              165             170             175

Leu Ile Leu Gly Ser Glu Glu Leu Trp Pro Val Leu Leu Gly Phe Thr
          180             185             190

Ile Leu Pro Ala Ile Leu Gln Ser Ala Ala Leu Pro Cys Cys Pro Glu
          195             200             205

Ser Pro Arg Phe Leu Leu Ile Asn Arg Lys Lys Glu Glu Asn Ala Thr
    210             215             220

Arg Ile Leu Gln Arg Leu Trp Gly Thr Gln Asp Val Ser Gln Asp Ile
225             230             235             240

Gln Glu Met Lys Asp Glu Ser Ala Arg Met Ser Gln Glu Lys Gln Val
              245             250             255

Thr Val Leu Glu Leu Phe Arg Val Ser Ser Tyr Arg Gln Pro Ile Ile
          260             265             270

Ile Ser Ile Val Leu Gln Leu Ser Gln Gln Leu Ser Gly Ile Asn Ala
    275             280             285

Val Phe Tyr Tyr Ser Thr Gly Ile Phe Lys Asp Ala Gly Val Gln Gln
    290             295             300

Pro Ile Tyr Ala Thr Ile Ser Ala Gly Val Val Asn Thr Ile Phe Thr
305             310             315             320

Leu Leu Ser Leu Phe Leu Val Glu Arg Ala Gly Arg Arg Thr Leu His
          325             330             335
```

```
Met Ile Gly Leu Gly Gly Met Ala Phe Cys Ser Thr Leu Met Thr Val
         340                 345                 350


Ser Leu Leu Leu Lys Asn His Tyr Asn Gly Met Ser Phe Val Cys Ile
         355                 360                 365


Gly Ala Ile Leu Val Phe Val Ala Cys Phe Glu Ile Gly Pro Gly Pro
    370                 375                 380


Ile Pro Trp Phe Ile Val Ala Glu Leu Phe Ser Gln Gly Pro Arg Pro
385                 390                 395                 400


Ala Ala Met Ala Val Ala Gly Cys Ser Asn Trp Thr Ser Asn Phe Leu
             405                 410                 415


Val Gly Leu Leu Phe Pro Ser Ala Ala Tyr Tyr Leu Gly Ala Tyr Val
             420                 425                 430


Phe Ile Ile Phe Thr Gly Phe Leu Ile Thr Phe Leu Ala Phe Thr Phe
         435                 440                 445


Phe Lys Val Pro Glu Thr Arg Gly Arg Thr Phe Glu Asp Ile Thr Arg
    450                 455                 460


Ala Phe Glu Gly Gln Ala His Gly Ala Asp Arg Ser Gly Lys Asp Gly
465                 470                 475                 480


Val Met Gly Met Asn Ser Ile Glu Pro Ala Lys Glu Thr Thr Thr Asn
             485                 490                 495


Val
```

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<400>  61
aattggaagc aaatgacatc acagcaggtc agagaaaaag ggttgagcgg caggcaccca      60

gagtagtagg tctttggcat taggagcttg agcccagacg gccctagcag ggaccccagc     120

gcccgagaga cc atg cag agg tcg cct ctg gaa aag gcc agc gtt gtc tcc     171
```

126

```
              Met Gln Arg Ser Pro Leu Glu Lys Ala Ser Val Val Ser
                1               5                  10

aaa ctt ttt ttc agc tgg acc aga cca att ttg agg aaa gga tac aga    219
Lys Leu Phe Phe Ser Trp Thr Arg Pro Ile Leu Arg Lys Gly Tyr Arg
    15              20                  25

cag cgc ctg gaa ttg tca gac ata tac caa atc cct tct gtt gat tct    267
Gln Arg Leu Glu Leu Ser Asp Ile Tyr Gln Ile Pro Ser Val Asp Ser
30                  35                  40                  45

gct gac aat cta tct gaa aaa ttg gaa aga gaa tgg gat aga gag ctg    315
Ala Asp Asn Leu Ser Glu Lys Leu Glu Arg Glu Trp Asp Arg Glu Leu
                50                  55                  60

gct tca aag aaa aat cct aaa ctc att aat gcc ctt cgg cga tgt ttt    363
Ala Ser Lys Lys Asn Pro Lys Leu Ile Asn Ala Leu Arg Arg Cys Phe
            65                  70                  75

ttc tgg aga ttt atg ttc tat gga atc ttt tta tat tta ggg gaa gtc    411
Phe Trp Arg Phe Met Phe Tyr Gly Ile Phe Leu Tyr Leu Gly Glu Val
        80                  85                  90

acc aaa gca gta cag cct ctc tta ctg gga aga atc ata gct tcc tat    459
Thr Lys Ala Val Gln Pro Leu Leu Leu Gly Arg Ile Ile Ala Ser Tyr
    95                  100                 105

gac ccg gat aac aag gag gaa cgc tct atc gcg att tat cta ggc ata    507
Asp Pro Asp Asn Lys Glu Glu Arg Ser Ile Ala Ile Tyr Leu Gly Ile
110                 115                 120                 125

ggc tta tgc ctt ctc ttt att gtg agg aca ctg ctc cta cac cca gcc    555
Gly Leu Cys Leu Leu Phe Ile Val Arg Thr Leu Leu Leu His Pro Ala
            130                 135                 140

att ttt ggc ctt cat cac att gga atg cag atg aga ata gct atg ttt    603
Ile Phe Gly Leu His His Ile Gly Met Gln Met Arg Ile Ala Met Phe
            145                 150                 155

agt ttg att tat aag aag act tta aag ctg tca agc cgt gtt cta gat    651
Ser Leu Ile Tyr Lys Lys Thr Leu Lys Leu Ser Ser Arg Val Leu Asp
            160                 165                 170

aaa ata agt att gga caa ctt gtt agt ctc ctt tcc aac aac ctg aac    699
Lys Ile Ser Ile Gly Gln Leu Val Ser Leu Leu Ser Asn Asn Leu Asn
            175                 180                 185

aaa ttt gat gaa gga ctt gca ttg gca cat ttc gtg tgg atc gct cct    747
Lys Phe Asp Glu Gly Leu Ala Leu Ala His Phe Val Trp Ile Ala Pro
190                 195                 200                 205

ttg caa gtg gca ctc ctc atg ggg cta atc tgg gag ttg tta cag gcg    795
Leu Gln Val Ala Leu Leu Met Gly Leu Ile Trp Glu Leu Leu Gln Ala
            210                 215                 220

tct gcc ttc tgt gga ctt ggt ttc ctg ata gtc ctt gcc ctt ttt cag    843
Ser Ala Phe Cys Gly Leu Gly Phe Leu Ile Val Leu Ala Leu Phe Gln
            225                 230                 235

gct ggg cta ggg aga atg atg atg aag tac aga gat cag aga gct ggg    891
Ala Gly Leu Gly Arg Met Met Met Lys Tyr Arg Asp Gln Arg Ala Gly
            240                 245                 250
```

127

```
aag atc agt gaa aga ctt gtg att acc tca gaa atg att gaa aat atc        939
Lys Ile Ser Glu Arg Leu Val Ile Thr Ser Glu Met Ile Glu Asn Ile
    255                 260                 265

caa tct gtt aag gca tac tgc tgg gaa gaa gca atg gaa aaa atg att        987
Gln Ser Val Lys Ala Tyr Cys Trp Glu Glu Ala Met Glu Lys Met Ile
270                 275                 280                 285

gaa aac tta aga caa aca gaa ctg aaa ctg act cgg aag gca gcc tat       1035
Glu Asn Leu Arg Gln Thr Glu Leu Lys Leu Thr Arg Lys Ala Ala Tyr
                290                 295                 300

gtg aga tac ttc aat agc tca gcc ttc ttc ttc tca ggg ttc ttt gtg      1083
Val Arg Tyr Phe Asn Ser Ser Ala Phe Phe Phe Ser Gly Phe Phe Val
            305                 310                 315

gtg ttt .tta tct gtg ctt ccc tat gca cta atc aaa gga atc atc ctc     1131
Val Phe Leu Ser Val Leu Pro Tyr Ala Leu Ile Lys Gly Ile Ile Leu
        320                 325                 330

cgg aaa ata ttc acc acc atc tca ttc tgc att gtt ctg cgc atg gcg     1179
Arg Lys Ile Phe Thr Thr Ile Ser Phe Cys Ile Val Leu Arg Met Ala
    335                 340                 345

gtc act cgg caa ttt ccc tgg gct gta caa aca tgg tat gac tct ctt     1227
Val Thr Arg Gln Phe Pro Trp Ala Val Gln Thr Trp Tyr Asp Ser Leu
350                 355                 360                 365

gga gca ata aac aaa ata cag gat ttc tta caa aag caa gaa tat aag     1275
Gly Ala Ile Asn Lys Ile Gln Asp Phe Leu Gln Lys Gln Glu Tyr Lys
                370                 375                 380

aca ttg gaa tat aac tta acg act aca gaa gta gtg atg gag aat gta     1323
Thr Leu Glu Tyr Asn Leu Thr Thr Thr Glu Val Val Met Glu Asn Val
            385                 390                 395

aca gcc ttc tgg gag gag gga ttt ggg gaa tta ttt gag aaa gca aaa     1371
Thr Ala Phe Trp Glu Glu Gly Phe Gly Glu Leu Phe Glu Lys Ala Lys
        400                 405                 410

caa aac aat aac aat aga aaa act tct aat ggt gat gac agc ctc ttc     1419
Gln Asn Asn Asn Asn Arg Lys Thr Ser Asn Gly Asp Asp Ser Leu Phe
    415                 420                 425

ttc agt aat ttc tca ctt ctt ggt act cct gtc ctg aaa gat att aat     1467
Phe Ser Asn Phe Ser Leu Leu Gly Thr Pro Val Leu Lys Asp Ile Asn
430                 435                 440                 445

ttc aag ata gaa aga gga cag ttg ttg gcg gtt gct gga tcc act gga     1515
Phe Lys Ile Glu Arg Gly Gln Leu Leu Ala Val Ala Gly Ser Thr Gly
                450 .               455                 460

gca ggc aag act tca ctt cta atg atg att atg gga gaa ctg gag cct     1563
Ala Gly Lys Thr Ser Leu Leu Met Met Ile Met Gly Glu Leu Glu Pro
                465                 470                 475

tca gag ggt aaa att aag cac agt gga aga att tca ttc tgt tct cag     1611
Ser Glu Gly Lys Ile Lys His Ser Gly Arg Ile Ser Phe Cys Ser Gln
            480                 485                 490

ttt tcc tgg att atg cct ggc acc att aaa gaa aat atc atc ggt gtt     1659
Phe Ser Trp Ile Met Pro Gly Thr Ile Lys Glu Asn Ile Ile Gly Val
    495                 500                 505
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tcc tat gat gaa tat aga tac aga agc gtc atc aaa gca tgc caa cta      1707
Ser Tyr Asp Glu Tyr Arg Tyr Arg Ser Val Ile Lys Ala Cys Gln Leu
510             515             520                     525

gaa gag gac atc tcc aag ttt gca gag aaa gac aat ata gtt ctt gga      1755
Glu Glu Asp Ile Ser Lys Phe Ala Glu Lys Asp Asn Ile Val Leu Gly
                530             535                 540

gaa ggt gga atc aca ctg agt gga ggt caa cga gca aga att tct tta      1803
Glu Gly Gly Ile Thr Leu Ser Gly Gly Gln Arg Ala Arg Ile Ser Leu
            545             550                 555

gca aga gca gta tac aaa gat gct gat ttg tat tta tta gac tct cct      1851
Ala Arg Ala Val Tyr Lys Asp Ala Asp Leu Tyr Leu Leu Asp Ser Pro
        560             565                 570

ttt gga tac cta gat gtt tta aca gaa aaa gaa ata ttt gaa agc tgt      1899
Phe Gly Tyr Leu Asp Val Leu Thr Glu Lys Glu Ile Phe Glu Ser Cys
        575             580                 585

gtc tgt aaa ctg atg gct aac aaa act agg att ttg gtc act tct aaa      1947
Val Cys Lys Leu Met Ala Asn Lys Thr Arg Ile Leu Val Thr Ser Lys
590             595             600                     605

atg gaa cat tta aag aaa gct gac aaa ata tta att ttg aat gaa ggt      1995
Met Glu His Leu Lys Lys Ala Asp Lys Ile Leu Ile Leu Asn Glu Gly
                610             615                 620

agc agc tat ttt tat ggg aca ttt tca gaa ctc caa aat cta cag cca      2043
Ser Ser Tyr Phe Tyr Gly Thr Phe Ser Glu Leu Gln Asn Leu Gln Pro
            625             630                 635

gac ttt agc tca aaa ctc atg gga tgt gat tct ttc gac caa ttt agt      2091
Asp Phe Ser Ser Lys Leu Met Gly Cys Asp Ser Phe Asp Gln Phe Ser
        640             645                 650

gca gaa aga aga aat tca atc cta act gag acc tta cac cgt ttc tca      2139
Ala Glu Arg Arg Asn Ser Ile Leu Thr Glu Thr Leu His Arg Phe Ser
655             660             665

tta gaa gga gat gct cct gtc tcc tgg aca gaa aca aaa aaa caa tct      2187
Leu Glu Gly Asp Ala Pro Val Ser Trp Thr Glu Thr Lys Lys Gln Ser
670             675             680                     685

ttt aaa cag act gga gag ttt ggg gaa aaa agg aag aat tct att ctc      2235
Phe Lys Gln Thr Gly Glu Phe Gly Glu Lys Arg Lys Asn Ser Ile Leu
                690             695                 700

aat cca atc aac tct ata cga aaa ttt tcc att gtg caa aag act ccc      2283
Asn Pro Ile Asn Ser Ile Arg Lys Phe Ser Ile Val Gln Lys Thr Pro
            705             710                 715

tta caa atg aat ggc atc gaa gag gat tct gat gag cct tta gag aga      2331
Leu Gln Met Asn Gly Ile Glu Glu Asp Ser Asp Glu Pro Leu Glu Arg
        720             725                 730

agg ctg tcc tta gta cca gat tct gag cag gga gag gcg ata ctg cct      2379
Arg Leu Ser Leu Val Pro Asp Ser Glu Gln Gly Glu Ala Ile Leu Pro
735             740                 745

cgc atc agc gtg atc agc act ggc ccc acg ctt cag gca cga agg agg      2427
Arg Ile Ser Val Ile Ser Thr Gly Pro Thr Leu Gln Ala Arg Arg Arg
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      . 750              755              760              765

cag tct gtc ctg aac ctg atg aca cac tca gtt aac caa ggt cag aac    2475
Gln Ser Val Leu Asn Leu Met Thr His Ser Val Asn Gln Gly Gln Asn
                770              775                  780

att cac cga aag aca aca gca tcc aca cga aaa gtg tca ctg gcc cct    2523
Ile His Arg Lys Thr Thr Ala Ser Thr Arg Lys Val Ser Leu Ala Pro
            785              790                  795

cag gca aac ttg act gaa ctg gat ata tat tca aga agg tta tct caa    2571
Gln Ala Asn Leu Thr Glu Leu Asp Ile Tyr Ser Arg Arg Leu Ser Gln
            800              805                  810

gaa act ggc ttg gaa ata agt gaa gaa att aac gaa gaa gac tta aag    2619
Glu Thr Gly Leu Glu Ile Ser Glu Glu Ile Asn Glu Glu Asp Leu Lys
            815              820                  825

gag tgc ctt ttt gat gat atg gag agc ata cca gca gtg act aca tgg    2667
Glu Cys Leu Phe Asp Asp Met Glu Ser Ile Pro Ala Val Thr Thr Trp
830              835              840                  845

aac aca tac ctt cga tat att act gtc cac aag agc tta att ttt gtg    2715
Asn Thr Tyr Leu Arg Tyr Ile Thr Val His Lys Ser Leu Ile Phe Val
                850              855                  860

cta att tgg tgc tta gta att ttt ctg gca gag gtg gct gct tct ttg    2763
Leu Ile Trp Cys Leu Val Ile Phe Leu Ala Glu Val Ala Ala Ser Leu
                865              870                  875

gtt gtg ctg tgg ctc ctt gga aac act cct ctt caa gac aaa ggg aat    2811
Val Val Leu Trp Leu Leu Gly Asn Thr Pro Leu Gln Asp Lys Gly Asn
                880              885                  890

agt act cat agt aga aat aac agc tat gca gtg att atc acc agc acc    2859
Ser Thr His Ser Arg Asn Asn Ser Tyr Ala Val Ile Ile Thr Ser Thr
            895              900                  905

agt tcg tat tat gtg ttt tac att tac gtg gga gta gcc gac act ttg    2907
Ser Ser Tyr Tyr Val Phe Tyr Ile Tyr Val Gly Val Ala Asp Thr Leu
910              915              920                  925

ctt gct atg gga ttc ttc aga ggt cta cca ctg gtg cat act cta atc    2955
Leu Ala Met Gly Phe Phe Arg Gly Leu Pro Leu Val His Thr Leu Ile
                930              935                  940

aca gtg tcg aaa att tta cac cac aaa atg tta cat tct gtt ctt caa    3003
Thr Val Ser Lys Ile Leu His His Lys Met Leu His Ser Val Leu Gln
            945              950                  955

gca cct atg tca acc ctc aac acg ttg aaa gca ggt ggg att ctt aat    3051
Ala Pro Met Ser Thr Leu Asn Thr Leu Lys Ala Gly Gly Ile Leu Asn
            960              965                  970

aga ttc tcc aaa gat ata gca att ttg gat gac ctt ctg cct ctt acc    3099
Arg Phe Ser Lys Asp Ile Ala Ile Leu Asp Asp Leu Leu Pro Leu Thr
            975              980                  985

ata ttt gac ttc atc cag ttg tta tta att gtg  att gga gct ata gca    3147
Ile Phe Asp Phe Ile Gln Leu Leu Leu Leu Ile Val  Ile Gly Ala Ile Ala
990              995              1000                 1005

gtt gtc gca gtt tta  caa ccc tac atc ttt  gtt gca aca gtg cca    3192
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130

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Val Val Ala Val Leu  Gln Pro Tyr Ile Phe  Val Ala Thr Val Pro
             1010                  1015              1020

gtg ata gtg gct ttt  att atg ttg aga gca  tat ttc ctc caa acc      3237
Val Ile Val Ala Phe  Ile Met Leu Arg Ala  Tyr Phe Leu Gln Thr
             1025                  1030              1035

tca cag caa ctc aaa  caa ctg gaa tct gaa  ggc agg agt cca att      3282
Ser Gln Gln Leu Lys  Gln Leu Glu Ser Glu  Gly Arg Ser Pro Ile
             1040                  1045              1050

ttc act cat ctt gtt  aca agc tta aaa gga  cta tgg aca ctt cgt      3327
Phe Thr His Leu Val  Thr Ser Leu Lys Gly  Leu Trp Thr Leu Arg
             1055                  1060              1065

gcc ttc gga cgg cag  cct tac ttt gaa act  ctg ttc cac aaa gct      3372
Ala Phe Gly Arg Gln  Pro Tyr Phe Glu Thr  Leu Phe His Lys Ala
             1070                  1075              1080

ctg aat tta cat act  gcc aac tgg ttc ttg  tac ctg tca aca ctg      3417
Leu Asn Leu His Thr  Ala Asn Trp Phe Leu  Tyr Leu Ser Thr Leu
             1085                  1090              1095

cgc tgg ttc caa atg  aga ata gaa atg att  ttt gtc atc ttc ttc      3462
Arg Trp Phe Gln Met  Arg Ile Glu Met Ile  Phe Val Ile Phe Phe
             1100                  1105              1110

att gct gtt acc ttc  att tcc att tta aca  aca gga gaa gga gaa      3507
Ile Ala Val Thr Phe  Ile Ser Ile Leu Thr  Thr Gly Glu Gly Glu
             1115                  1120              1125

gga aga gtt ggt att  atc ctg act tta gcc  atg aat atc atg agt      3552
Gly Arg Val Gly Ile  Ile Leu Thr Leu Ala  Met Asn Ile Met Ser
             1130                  1135              1140

aca ttg cag tgg gct  gta aac tcc agc ata  gat gtg gat agc ttg      3597
Thr Leu Gln Trp Ala  Val Asn Ser Ser Ile  Asp Val Asp Ser Leu
             1145                  1150              1155

atg cga tct gtg agc  cga gtc ttt aag ttc  att gac atg cca aca      3642
Met Arg Ser Val Ser  Arg Val Phe Lys Phe  Ile Asp Met Pro Thr
             1160                  1165              1170

gaa ggt aaa cct acc  aag tca acc aaa cca  tac aag aat ggc caa      3687
Glu Gly Lys Pro Thr  Lys Ser Thr Lys Pro  Tyr Lys Asn Gly Gln
             1175                  1180              1185

ctc tcg aaa gtt atg  att att gag aat tca  cac gtg aag aaa gat      3732
Leu Ser Lys Val Met  Ile Ile Glu Asn Ser  His Val Lys Lys Asp
             1190                  1195              1200

gac atc tgg ccc tca  ggg ggc caa atg act  gtc aaa gat ctc aca      3777
Asp Ile Trp Pro Ser  Gly Gly Gln Met Thr  Val Lys Asp Leu Thr
             1205                  1210              1215

gca aaa tac aca gaa  ggt gga aat gcc ata  tta gag aac att tcc      3822
Ala Lys Tyr Thr Glu  Gly Gly Asn Ala Ile  Leu Glu Asn Ile Ser
             1220                  1225              1230

ttc tca ata agt cct  ggc cag agg gtg ggc  ctc ttg gga aga act      3867
Phe Ser Ile Ser Pro  Gly Gln Arg Val Gly  Leu Leu Gly Arg Thr
             1235                  1240              1245
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gga tca ggg aag agt  act ttg tta tca gct  ttt ttg aga cta ctg       3912
Gly Ser Gly Lys Ser  Thr Leu Leu Ser Ala  Phe Leu Arg Leu Leu
            1250               1255               1260

aac act gaa gga gaa  atc cag atc gat ggt  gtg tct tgg gat tca       3957
Asn Thr Glu Gly Glu  Ile Gln Ile Asp Gly  Val Ser Trp Asp Ser
            1265               1270               1275

ata act ttg caa cag  tgg agg aaa gcc ttt  gga gtg ata cca cag       4002
Ile Thr Leu Gln Gln  Trp Arg Lys Ala Phe  Gly Val Ile Pro Gln
            1280               1285               1290

aaa gta ttt att ttt  tct gga aca ttt aga  aaa aac ttg gat ccc       4047
Lys Val Phe Ile Phe  Ser Gly Thr Phe Arg  Lys Asn Leu Asp Pro
            1295               1300               1305

tat gaa cag tgg agt  gat caa gaa ata tgg  aaa gtt gca gat gag       4092
Tyr Glu Gln Trp Ser  Asp Gln Glu Ile Trp  Lys Val Ala Asp Glu
            1310               1315               1320

gtt ggg ctc aga tct  gtg ata gaa cag ttt  cct ggg aag ctt gac       4137
Val Gly Leu Arg Ser  Val Ile Glu Gln Phe  Pro Gly Lys Leu Asp
            1325               1330               1335

ttt gtc ctt gtg gat  ggg ggc tgt gtc cta  agc cat ggc cac aag       4182
Phe Val Leu Val Asp  Gly Gly Cys Val Leu  Ser His Gly His Lys
            1340               1345               1350

cag ttg atg tgc ttg  gct aga tct gtt ctc  agt aag gcg aag atc       4227
Gln Leu Met Cys Leu  Ala Arg Ser Val Leu  Ser Lys Ala Lys Ile
            1355               1360               1365

ttg ctg ctt gat gaa  ccc agt gct cat ttg  gat cca gta aca tac       4272
Leu Leu Leu Asp Glu  Pro Ser Ala His Leu  Asp Pro Val Thr Tyr
            1370               1375               1380

caa ata att aga aga  act cta aaa caa gca  ttt gct gat tgc aca       4317
Gln Ile Ile Arg Arg  Thr Leu Lys Gln Ala  Phe Ala Asp Cys Thr
            1385               1390               1395

gta att ctc tgt gaa  cac agg ata gaa gca  atg ctg gaa tgc caa       4362
Val Ile Leu Cys Glu  His Arg Ile Glu Ala  Met Leu Glu Cys Gln
            1400               1405               1410

caa ttt ttg gtc ata  gaa gag aac aaa gtg  cgg cag tac gat tcc       4407
Gln Phe Leu Val Ile  Glu Glu Asn Lys Val  Arg Gln Tyr Asp Ser
            1415               1420               1425

atc cag aaa ctg ctg  aac gag agg agc ctc  ttc cgg caa gcc atc       4452
Ile Gln Lys Leu Leu  Asn Glu Arg Ser Leu  Phe Arg Gln Ala Ile
            1430               1435               1440

agc ccc tcc gac agg  gtg aag ctc ttt ccc  cac cgg aac tca agc       4497
Ser Pro Ser Asp Arg  Val Lys Leu Phe Pro  His Arg Asn Ser Ser
            1445               1450               1455

aag tgc aag tct aag  ccc cag att gct gct  ctg aaa gag gag aca       4542
Lys Cys Lys Ser Lys  Pro Gln Ile Ala Ala  Leu Lys Glu Glu Thr
            1460               1465               1470

gaa gaa gag gtg caa  gat aca agg ctt tag agagcagcat aaatgttgac     4592
Glu Glu Glu Val Gln  Asp Thr Arg Leu
            1475
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132

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atgggacatt tgctcatgga attggagctc gtgggacagt cacctcatgg aattggagct    4652

cgtggaacag ttacctctgc ctcagaaaac aaggatgaat taagtttttt tttaaaaaag    4712

aaacatttgg taaggggaat.tgaggacact gatatgggtc ttgataaatg gcttcctggc   ·4772

aatagtcaaa ttgtgtgaaa ggtacttcaa atccttgaag atttaccact tgtgttttgc    4832

aagccagatt ttcctgaaaa cccttgccat gtgctagtaa ttggaaaggc agctctaaat    4892

gtcaatcagc ctagttgatc agcttattgt ctagtgaaac tcgttaattt gtagtgttgg    4952

agaagaactg aaatcatact tcttagggtt atgattaagt aatgataact ggaaacttca    5012

gcggtttata taagcttgta ttcctttttc tctcctctcc ccatgatgtt tagaaacaca    5072

actatattgt ttgctaagca ttccaactat ctcatttcca agcaagtatt agaataccac    5132

aggaaccaca agactgcaca tcaaaatatg ccccattcaa catctagtga gcagtcagga    5192

aagagaactt ccagatcctg gaaatcaggg ttagtattgt ccaggtctac caaaaatctc    5252

aatatttcag ataatcacaa tacatccctt acctgggaaa gggctgttat aatctttcac    5312

aggggacagg atggttccct tgatgaagaa gttgatatgc cttttcccaa ctccagaaag    5372

tgacaagctc acagaccttt gaactagagt ttagctggaa aagtatgtta gtgcaaattg    5432

tcacaggaca gcccttcttt ccacagaagc tccaggtaga gggtgtgtaa gtagataggc    5492

catgggcact gtgggtagac acacatgaag tccaagcatt tagatgtata ggttgatggt    5552

ggtatgtttt caggctagat gtatgtactt catgctgtct acactaagag agaatgagag    5612

acacactgaa gaagcaccaa tcatgaatta gttttatatg cttctgtttt ataattttgt    5672

gaagcaaaat ttttctcta ggaaatattt attttaataa tgtttcaaac atatattaca     5732

atgctgtatt ttaaaagaat gattatgaat tacatttgta taaaataatt tttatatttg    5792

aaatattgac tttttatggc actagtattt ttatgaaata ttatgttaaa actgggacag    5852

gggagaacct agggtgatat taaccagggg ccatgaatca ccttttggtc tggagggaag    5912·

ccttggggct gatcgagttg ttgcccacag ctgtatgatt cccagccaga cacagcctct    5972

tagatgcagt tctgaagaag atggtaccac cagtctgact gtttccatca agggtacact    6032

gccttctcaa ctccaaactg actcttaaga agactgcatt atatttatta ctgtaagaaa    6092

atatcacttg tcaataaaat ccatacattt gtgt                                6126
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<210> 62
<211> 1479
<212> PRT
<213>   Cystic Fibrosis Transmembrane Conductor Regulator (CFTR) delta F508
mutation

<400> 62

Met Gln Arg Ser Pro Leu Glu Lys Ala Ser Val Val Ser Lys Leu Phe

133

1				5				10				15			

Phe Ser Trp Thr Arg Pro Ile Leu Arg Lys Gly Tyr Arg Gln Arg Leu
      20   25   30

Glu Leu Ser Asp Ile Tyr Gln Ile Pro Ser Val Asp Ser Ala Asp Asn
      35   40   45

Leu Ser Glu Lys Leu Glu Arg Glu Trp Asp Arg Glu Leu Ala Ser Lys
  50   55   60

Lys Asn Pro Lys Leu Ile Asn Ala Leu Arg Arg Cys Phe Phe Trp Arg
65   70   75   80

Phe Met Phe Tyr Gly Ile Phe Leu Tyr Leu Gly Glu Val Thr Lys Ala
         85   90   95

Val Gln Pro Leu Leu Leu Gly Arg Ile Ile Ala Ser Tyr Asp Pro Asp
        100   105   110

Asn Lys Glu Glu Arg Ser Ile Ala Ile Tyr Leu Gly Ile Gly Leu Cys
      115   120   125

Leu Leu Phe Ile Val Arg Thr Leu Leu Leu His Pro Ala Ile Phe Gly
      130   135   140

Leu His His Ile Gly Met Gln Met Arg Ile Ala Met Phe Ser Leu Ile
145   150   155   160

Tyr Lys Lys Thr Leu Lys Leu Ser Ser Arg Val Leu Asp Lys Ile Ser
         165   170   175

Ile Gly Gln Leu Val Ser Leu Leu Ser Asn Asn Leu Asn Lys Phe Asp
        180   185   190

Glu Gly Leu Ala Leu Ala His Phe Val Trp Ile Ala Pro Leu Gln Val
      195   200   205

Ala Leu Leu Met Gly Leu Ile Trp Glu Leu Leu Gln Ala Ser Ala Phe
      210   215   220

Cys Gly Leu Gly Phe Leu Ile Val Leu Ala Leu Phe Gln Ala Gly Leu
225   230   235   240

Gly Arg Met Met Met Lys Tyr Arg Asp Gln Arg Ala Gly Lys Ile Ser
        245   250   255

134

Glu Arg Leu Val Ile Thr Ser Glu Met Ile Glu Asn Ile Gln Ser Val
          260   265   270

Lys Ala Tyr Cys Trp Glu Glu Ala Met Glu Lys Met Ile Glu Asn Leu
         275   280   285

Arg Gln Thr Glu Leu Lys Leu Thr Arg Lys Ala Ala Tyr Val Arg Tyr
  290   295   300

Phe Asn Ser Ser Ala Phe Phe Phe Ser Gly Phe Phe Val Val Phe Leu
305   310   315   320

Ser Val Leu Pro Tyr Ala Leu Ile Lys Gly Ile Ile Leu Arg Lys Ile
         325   330   335

Phe Thr Thr Ile Ser Phe Cys Ile Val Leu Arg Met Ala Val Thr Arg
         340   345   350

Gln Phe Pro Trp Ala Val Gln Thr Trp Tyr Asp Ser Leu Gly Ala Ile
         355   360   365

Asn Lys Ile Gln Asp Phe Leu Gln Lys Gln Glu Tyr Lys Thr Leu Glu
         370   375   380

Tyr Asn Leu Thr Thr Thr Glu Val Val Met Glu Asn Val Thr Ala Phe
385   390   395   400

Trp Glu Glu Gly Phe Gly Glu Leu Phe Glu Lys Ala Lys Gln Asn Asn
           405   410   415

Asn Asn Arg Lys Thr Ser Asn Gly Asp Asp Ser Leu Phe Phe Ser Asn
         420   425   430

Phe Ser Leu Leu Gly Thr Pro Val Leu Lys Asp Ile Asn Phe Lys Ile
         435   440   445

Glu Arg Gly Gln Leu Leu Ala Val Ala Gly Ser Thr Gly Ala Gly Lys
       450   455   460

Thr Ser Leu Leu Met Met Ile Met Gly Glu Leu Glu Pro Ser Glu Gly
465   470   475   480

Lys Ile Lys His Ser Gly Arg Ile Ser Phe Cys Ser Gln Phe Ser Trp
           485   490   495

Ile Met Pro Gly Thr Ile Lys Glu Asn Ile Ile Gly Val Ser Tyr Asp
         500   505   510

135

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Glu Tyr Arg Tyr Arg Ser Val Ile Lys Ala Cys Gln Leu Glu Glu Asp
        515                 520             525


Ile Ser Lys Phe Ala Glu Lys Asp Asn Ile Val Leu Gly Glu Gly Gly
    530             535                 540


Ile Thr Leu Ser Gly Gly Gln Arg Ala Arg Ile Ser Leu Ala Arg Ala
545             550                 555                 560


Val Tyr Lys Asp Ala Asp Leu Tyr Leu Leu Asp Ser Pro Phe Gly Tyr
            565             570                 575


Leu Asp Val Leu Thr Glu Lys Glu Ile Phe Glu Ser Cys Val Cys Lys
            580                 585             590


Leu Met Ala Asn Lys Thr Arg Ile Leu Val Thr Ser Lys Met Glu His
        595                 600             605


Leu Lys Lys Ala Asp Lys Ile Leu Ile Leu Asn Glu Gly Ser Ser Tyr
    610                 615                 620


Phe Tyr Gly Thr Phe Ser Glu Leu Gln Asn Leu Gln Pro Asp Phe Ser
625                 630                 635                 640


Ser Lys Leu Met Gly Cys Asp Ser Phe Asp Gln Phe Ser Ala Glu Arg
            645                 650                 655


Arg Asn Ser Ile Leu Thr Glu Thr Leu His Arg Phe Ser Leu Glu Gly
            660                 665                 670


Asp Ala Pro Val Ser Trp Thr Glu Thr Lys Lys Gln Ser Phe Lys Gln
            675                 680                 685


Thr Gly Glu Phe Gly Glu Lys Arg Lys Asn Ser Ile Leu Asn Pro Ile
    690                 695                 700


Asn Ser Ile Arg Lys Phe Ser Ile Val Gln Lys Thr Pro Leu Gln Met
705                 710                 715                 720


Asn Gly Ile Glu Glu Asp Ser Asp Glu Pro Leu Glu Arg Arg Leu Ser
            725                 730                 735


Leu Val Pro Asp Ser Glu Gln Gly Glu Ala Ile Leu Pro Arg Ile Ser
            740                 745                 750


Val Ile Ser Thr Gly Pro Thr Leu Gln Ala Arg Arg Arg Gln Ser Val
    755                 760                 765
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Leu Asn Leu Met Thr His Ser Val Asn Gln Gly Gln Asn Ile His Arg
    770             775             780

Lys Thr Thr Ala Ser Thr Arg Lys Val Ser Leu Ala Pro Gln Ala Asn
785             790             795             800

Leu Thr Glu Leu Asp Ile Tyr Ser Arg Arg Leu Ser Gln Glu Thr Gly
                805             810             815

Leu Glu Ile Ser Glu Glu Ile Asn Glu Glu Asp Leu Lys Glu Cys Leu
            820             825             830

Phe Asp Asp Met Glu Ser Ile Pro Ala Val Thr Thr Trp Asn Thr Tyr
        835             840             845

Leu Arg Tyr Ile Thr Val His Lys Ser Leu Ile Phe Val Leu Ile Trp
    850             855             860

Cys Leu Val Ile Phe Leu Ala Glu Val Ala Ala Ser Leu Val Val Leu
865             870             875             880

Trp Leu Leu Gly Asn Thr Pro Leu Gln Asp Lys Gly Asn Ser Thr His
            885             890             895

Ser Arg Asn Asn Ser Tyr Ala Val Ile Ile Thr Ser Thr Ser Ser Tyr
            900             905             910

Tyr Val Phe Tyr Ile Tyr Val Gly Val Ala Asp Thr Leu Leu Ala Met
    915             920             925

Gly Phe Phe Arg Gly Leu Pro Leu Val His Thr Leu Ile Thr Val Ser
    930             935             940

Lys Ile Leu His His Lys Met Leu His Ser Val Leu Gln Ala Pro Met
945             950             955             960

Ser Thr Leu Asn Thr Leu Lys Ala Gly Gly Ile Leu Asn Arg Phe Ser
            965             970             975

Lys Asp Ile Ala Ile Leu Asp Asp Leu Leu Pro Leu Thr Ile Phe Asp
        980             985             990

Phe Ile Gln Leu Leu Leu Ile Val  Ile Gly Ala Ile Ala  Val Val Ala
    995             1000            1005

Val Leu  Gln Pro Tyr Ile Phe  Val Ala Thr Val Pro  Val Ile Val
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            1010                    1015                    1020

    Ala Phe  Ile Met Leu Arg Ala  Tyr Phe Leu Gln Thr  Ser Gln Gln
        1025                    1030                    1035


    Leu Lys  Gln Leu Glu Ser Glu  Gly Arg Ser Pro Ile  Phe Thr His
        1040                    1045                    1050


    Leu Val  Thr Ser Leu Lys Gly  Leu Trp Thr Leu Arg  Ala Phe Gly
        1055                  .  1060                    1065


    Arg Gln  Pro Tyr Phe Glu Thr  Leu Phe His Lys Ala  Leu Asn Leu
        1070                    1075                    1080


    His Thr  Ala Asn Trp Phe Leu  Tyr Leu Ser Thr Leu  Arg Trp Phe
        1085                    1090                    1095


    Gln Met  Arg Ile Glu Met Ile  Phe Val Ile Phe Phe  Ile Ala Val
        1100                    1105                    1110


    Thr Phe  Ile Ser Ile Leu Thr  Thr Gly Glu Gly Glu  Gly Arg Val
        1115                    1120                    1125


    Gly Ile  Ile Leu Thr Leu Ala  Met Asn Ile Met Ser  Thr Leu Gln
        1130                    1135                    1140


    Trp Ala  Val Asn Ser Ser Ile  Asp Val Asp Ser Leu  Met Arg Ser
        1145                    1150                    1155


    Val Ser  Arg Val Phe Lys Phe  Ile Asp Met Pro Thr  Glu Gly Lys
        1160                    1165                    1170


    Pro Thr  Lys Ser Thr Lys Pro  Tyr Lys Asn Gly Gln  Leu Ser Lys
        1175                    1180                    1185


    Val Met  Ile Ile Glu Asn Ser  His Val Lys Lys Asp  Asp Ile Trp
        1190                    1195                    1200


    Pro Ser  Gly Gly Gln Met Thr  Val Lys Asp Leu Thr  Ala Lys Tyr
        1205                    1210                    1215


    Thr Glu  Gly Gly Asn Ala Ile  Leu Glu Asn Ile Ser  Phe Ser Ile
        1220                    1225                    1230


    Ser Pro  Gly Gln Arg Val Gly  Leu Leu Gly Arg Thr  Gly Ser Gly
        1235                    1240                    1245
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Lys Ser Thr Leu Leu Ser Ala Phe Leu Arg Leu Leu Asn Thr Glu
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Gly Glu Ile Gln Ile Asp Gly Val Ser Trp Asp Ser Ile Thr Leu
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Gln Gln Trp Arg Lys Ala Phe Gly Val Ile Pro Gln Lys Val Phe
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Ile Phe Ser Gly Thr Phe Arg Lys Asn Leu Asp Pro Tyr Glu Gln
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Trp Ser Asp Gln Glu Ile Trp Lys Val Ala Asp Glu Val Gly Leu
    1310            1315            1320

Arg Ser Val Ile Glu Gln Phe Pro Gly Lys Leu Asp Phe Val Leu
    1325            1330            1335

Val Asp Gly Gly Cys Val Leu Ser His Gly His Lys Gln Leu Met
    1340            1345            1350

Cys Leu Ala Arg Ser Val Leu Ser Lys Ala Lys Ile Leu Leu Leu
    1355            1360            1365

Asp Glu Pro Ser Ala His Leu Asp Pro Val Thr Tyr Gln Ile Ile
    1370            1375            1380

Arg Arg Thr Leu Lys Gln Ala Phe Ala Asp Cys Thr Val Ile Leu
    1385            1390            1395

Cys Glu His Arg Ile Glu Ala Met Leu Glu Cys Gln Gln Phe Leu
    1400            1405            1410

Val Ile Glu Glu Asn Lys Val Arg Gln Tyr Asp Ser Ile Gln Lys
    1415            1420            1425

Leu Leu Asn Glu Arg Ser Leu Phe Arg Gln Ala Ile Ser Pro Ser
    1430            1435            1440

Asp Arg Val Lys Leu Phe Pro His Arg Asn Ser Ser Lys Cys Lys
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Ser Lys Pro Gln Ile Ala Ala Leu Lys Glu Glu Thr Glu Glu Glu
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Val Gln Asp Thr Arg Leu
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